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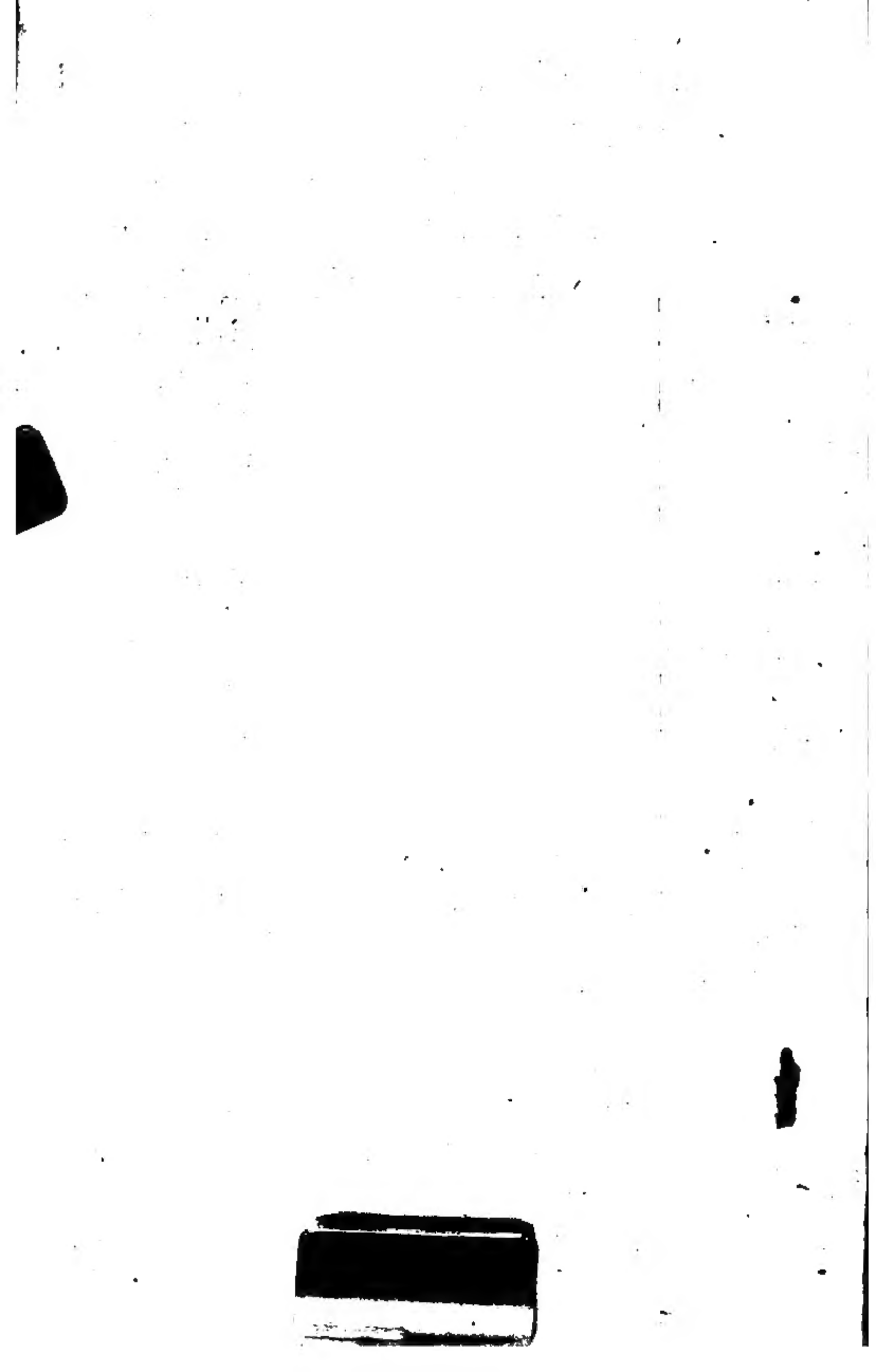
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Public Documents of Massachusetts :

BRING THE

ANNUAL REPORTS

OF VARIOUS

PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEAR

1896.

PUBLISHED BY THE SECRETARY OF THE COMMONWEALTH.

Vol. XII.

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REPORT OF THE COMMISSIONERS

ON

INLAND FISHERIES AND GAME

FOR THE

YEAR ENDING DECEMBER 31, 1896.

BOSTON :
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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Commonwealth of Massachusetts.

To His Excellency the Governor and Honorable Council.

The Commissioners on Inland Fisheries and Game respectfully present their thirty-first annual report.

FISHWAYS.

The fishway on the Nemasket River, at Middleborough, over what is known as Sherman's dam, was out of repair, and, as the town of Middleborough had bought 75 horse-power of this privilege and was also directly interested in the fisheries of the river, deriving an income of about \$500 per annum therefrom, it was felt that the town might be willing to put the fishway in order, and accordingly we had an interview with the selectmen, who agreed to see that it was done.

When notice and plans were sent them, they, by advice of their counsel, claimed that they were not obliged to do the work, and refused to take any responsibility in regard to it. As the property is more or less encumbered, it was necessary to ascertain who were the legal owners, and in June the case was put in the hands of the Attorney-General. After much delay, the responsible parties were found and notice served on them. As the water was very high, an extension of time was asked, with the agreement that it should be done before the first of January. We feel confident that the agreement will be kept.

LAWRENCE FISHWAY.

The freshet of last spring so damaged this fishway as to render it useless, and it was not until near the close of the legislative session that the water receded sufficiently to show the full extent of the injury. As soon as possible an estimate was made as to the amount of money required to repair it, and a resolve put into the Legislature, but it failed to pass.

By agreement, the Essex County pays one-half the expense of the building and maintenance of this fishway, and we recommend that the State appropriate a sum sufficient to pay the other half.

CARP (*Cyprinus Carpio*).

About 1,200 carp, ranging in size from fingerlings to two pounds in weight, have been distributed during the past year.

Owing to the small demand for these fish, the breeding ponds at Tewksbury have been discontinued, and applicants will hereafter be supplied from a flowed meadow in the Middlesex Fells, which was stocked a few years ago, and now contains a large number of carp from three inches in length to fifteen pounds in weight. The large fish can be caught with hook and line, but will require constant care in transportation.

The late Professor Baird, United States commissioner of fisheries, before introducing the carp into this country, made a careful investigation of its habits and value as food. He found that in Austria, where they were domesticated as early as 1367, carp culture is a large and profitable industry; and in one establishment in Bohemia, owned by the princes of Schwartzenberg, no less than 20,000 acres are covered by artificial ponds, the proceeds of which amount to about 500,000 pounds of carp annually. It is one of the leading fish in their markets, commanding a good price, the quality, as food, being considered not inferior to most salt-water fish.

Carp are found in many of our lakes, ponds and rivers, where, except in a few cases, they have no commercial value. This distribution was never intended by Professor Baird, but many applicants, disregarding his instructions, dumped them into streams, ponds and mudholes, where it suited their convenience, with the result that many persons have become prejudiced against them, claiming that they are worthless for the table; and many fishermen, who have destroyed their industry by overfishing, have laid the blame on the carp as the destroyers of the spawn of other fish.

Carp are taken in the great lakes and sold in the surrounding cities, where they are found on bills of fare at hotels and restaurants.

They are very prolific, but entirely defenceless, and, when placed in waters containing carnivorous fish, do not as a rule

increase to any considerable extent. It is only in artificially constructed ponds, where they can be protected from their enemies, that they become valuable. As they are vegetable feeders, flowed meadows and ponds with grassy bottoms are best adapted to them. If taken from these ponds (the greater part of which should be shallow) in summer, when the water is warm, the flesh is soft, and has a muddy flavor; but this is easily changed by keeping them in clear cold water for a few days before using them.

The carp is, of all fish, the most easily cultivated, and in properly arranged ponds, where they are under control, can be made more profitable than any other fish, the outlay being small, and the price, in Boston market, from eighteen to twenty cents per pound.

TROUT.

Between 500,000 and 600,000 trout fry were hatched last spring. A list of the distribution will be found in the Appendix.

The hatchery at Sutton, as will be seen by the following report, is in good working order:—

SUTTON, Dec. 10, 1896.

Commissioners on Inland Fisheries and Game.

GENTLEMEN:—I submit the following report in relation to the condition of this hatchery at the present time, and a statement of the work that has been done in connection with the same since I took charge of it one year ago.

To increase the conveniences for raising young trout, a runway, 130 feet long, 8 feet wide and 3 feet deep, has been constructed in the stream south of the hatchery. It is made of plank, on a stone and gravel foundation, and has five apartments through which the water flows at a depth of from 10 to 18 inches. It has proved well adapted to the purpose for which it was constructed. A six-inch driven well has been sunk to a depth of 28 feet, near the head of the pond, and now furnishes a sufficient supply of pure water to run the hatchery, making a saving of much labor in the care of the eggs.

At the present time there are 600,000 trout eggs in the hatchery, in excellent condition, and there is a prospect of adding several thousand more before the season closes.

There have been added to the breeding fish this year, by purchase, 400 females and 300 males, now eighteen months old, and I have caught from streams near by and put into the pond 220 females and 125 males, making the total number of fish on hand 2,690.

There has been a considerable loss of large fish by disease, — a species of fungus that attacked the throat. During the summer a forest fire consumed two hundred cords of wood on the north side of the pond, and the flow of wood ashes into the pond by rain storms was such as to greatly change the color of the water, and may have caused the loss of the fish.

The hatchery is now supplied with all conveniences for its successful operation.

Respectfully,

WM. E. PILLSBURY,
In Charge of the State Fish Hatchery, Sutton, Mass.

HATCHERY AT EAST HADLEY.

A Resolve was passed by the last Legislature, appropriating \$3,000 for a hatchery to accommodate the western part of the State. The commissioners, after carefully considering the several places recommended, unanimously decided that the location at East Hadley was not only the best adapted to the work but also would best accommodate that whole section.

Although it was late when a decision was reached, steps were at once taken to complete the work, so as to be able to put in a considerable number of eggs by the middle of January.

Under the direction of the commission, Deputy John W. Delano was put in charge of the construction, and on December 14 made the following report : —

Commissioners on Inland Fisheries and Game.

GENTLEMEN : — The work of building the new hatchery at East Hadley has been pushed forward as rapidly as possible, and at this time is about finished, except putting in and piping the hatching troughs, which we hope will be completed and in running order in about ten days.

The site secured takes in something over 7 acres, including a pond of 1 acre, of nice spring water, with a fall of 10 feet to the stream below the dam, two never-failing springs of as pure, clear water as can be found in the State, and the control of 12 feet on each side of the stream and below the pond for a distance of at least 1,000 feet.

The hatchery building, 41 by 28 feet, with 8-foot walls, is built of brick, with an additional 8 feet of woodwork in front, giving the main room 26 by 39 feet and two rooms in front 8 by 11 feet. The building being built on the slope, the ground is graded 3 feet high to the window sills, and without a doubt the main room can be kept sufficiently warm without a fire.

An inch and a half pipe, 300 feet long, connects the building and the middle spring, giving a never-failing supply of water, with a fall of 30 feet.

The ice house, 9 by 13 feet, located near the pond, will be finished during the week.

As the season was so far advanced, I thought it advisable not to do any more work than was necessary to the road from the highway to the hatchery building. I had the bridge new topped, the low places in the dam filled up and substantial posts and railings put on both sides of the dam, giving a safe and fairly good road from the highway to the building.

Respectfully submitted,

JOHN W. DELANO.

HATCHERY AT WINCHESTER.

In last year's report the following statement was made in regard to this hatchery : —

The State hatchery at Winchester needs rebuilding ; it cannot be safely run another season. As a centre of distribution for the southern and eastern part of the State, it is desirable that its location should not be materially changed.

The principal part of this hatchery was built by the present chairman of the Board, at his own expense (for which no reimbursement has ever been made), before he was on the commission, and, with the exception of a small addition and occasional repairs, has never cost the State anything except the running expenses, which have been slight. From this hatchery an average of about 600,000 fish have been distributed annually over the State, — over 15,000,000 in all.

As the house must either be rebuilt or abandoned, we recommend that it be rebuilt a few rods below its present location, on land belonging to the State and under the charge of the Metropolitan Park Commission, and that a sufficient sum of money be appropriated to build a house worthy of the location.

No action was taken on this recommendation. Unless provision is made to rebuild this hatchery the coming season, the people of the eastern and southern sections of the State will be deprived of the privilege they have enjoyed for the last twenty-five years.

LOBSTERS.

An effort was made in the last Legislature, originating, mainly, from fishermen who were either persistent in violating

the law or openly opposed to all laws for the protection of fish and game, to reduce the legal length of the lobster from ten and one-half inches to nine inches. A singular fact in connection with this was, that the Southern Fish and Game Association, hitherto supposed to be in favor of protecting our fisheries, lent whatever influence they had in favor of this suicidal act.

After a heated discussion, it passed the Senate by one vote, and would have become a law but for the timely intervention of the governor, who, in the interest of the Commonwealth as well as of the fishermen, vetoed the bill.

We have hitherto called attention to the decline of this important industry, and the spasmodic efforts to change the law are direct evidence of the fact. Had the catch of large lobsters not fallen off, the fishermen would not have asked to have the legal length changed. The lobsters caught in this State, with one or two local exceptions, are hardly above the legal length, which is, on the north shore and largely on the south, below the spawning size; and the natural consequence is that the number of egg-bearing lobsters has fallen off over fifty per cent. in the last six years, and the catch per pot about forty per cent. Unless some change is made for the better protection of this valuable fish, this decline will continue.

There has been no improvement on the part of those who have for years violated the law. The records of our deputies show that there have been over \$6,000 fines awarded by the courts, mainly for violations of the lobster law.

This unfortunate condition of things can be to a great degree rectified by compelling the fishermen to take out a license, under penalty of forfeiture for non-compliance, and to place the slats on the lobster pots sufficiently wide apart to allow the small lobsters to escape, on the same principle that the mesh of seines is regulated.

WEIRS, POUNDS AND NETS.

The returns show an increase in the catch of mackerel over last season, but the most of them were taken in June and July. During these months there appeared to be large quantities of mackerel on the coast, of superior quality, such as have not been seen for years, and were of great benefit to the fish weirs and net fishermen; also the mackerel fleet made good catches

off the coast and at George's banks, and it appeared during these months that they would have an old-time catch, but after the first of August they disappeared, and were not seen by any of the fleet that cruised from Cape Cod to the Nova Scotia coast. Later, some mackerel were found off Block Island and the Vineyard Islands, and immense quantities of sea herring were in Barnstable Bay and the harbor of Provincetown, which was a great help to the boat fishermen of that locality; but, like the past few years, it has not been a profitable season for those engaged in the shore fisheries.

STATE STEAMER.

After painting and completing the necessary repairs, the steamer was put in commission May 16, and was located in Buzzard's Bay and adjoining waters during the entire season. Menhaden have been plentiful in the bay, and schooled freely all the season. No violation of the laws by fishing steamers have been reported.

Captain Proctor reports that he has investigated 70 cases and made 64 arrests, with fines imposed to the amount of \$3,614.50, and has seized 11,372 lobsters.

The menhaden left the bay about the first of October, and the steamer was laid up at dock in New Bedford October 8. She will require considerable repairs to hull, machinery and boiler to do the work required for another season.

MONGOLIAN PHEASANTS.

The propagation and distribution of Mongolian pheasants has been successfully carried on during the past season at the State aviaries. Something over 200 chicks, which had been allowed their freedom in the large enclosure, were trapped in October and put in a covered corral 28 by 60 feet in area. But this proved too small for so many birds, and there was a small loss in consequence of the stronger birds picking upon the weaker ones. This will be obviated next year by sending the birds out as soon as they are trapped, not waiting to determine the sex, which takes from four to six months.

A few birds were distributed last year to responsible parties, with the understanding that they were to breed and turn them out in their respective localities. Only three were successful

in raising birds. We give below their statements, showing their experience and indicating the feeling of all, for even those who failed are not discouraged, but are confident that past experience will lead to success in the future.

In the spring of 1895 Dr. White of Sandwich was furnished with a setting of eggs, from which he raised one bird, a female, and last spring we sent him a mate. To our inquiries he sent the following reply : —

My pheasants are doing nicely. I have twenty good, healthy birds, two of which are cocks, with eighteen hens. I found that the utmost care has to be taken of them until they are about a month old, then they are hardy, and seem to withstand any kind of climate or weather.

My one hen last season laid eighty-two eggs, but, as there was but one cock, over half of the eggs were not fertile. I am in hopes to form a club here, and go to raising them more extensively. They are a splendid game bird, and the State ought to appropriate more money for the purpose of increasing the supply, and get them more generally introduced in the State.

Sincerely yours,

G. E. WHITE, M. D.

SANDWICH, MASS.

The doctor is at fault in supposing that the infertility of the eggs was due to the fact that he had but one male. At the State aviary it has been our experience that the eggs are generally fertile, and the rule is one cock and three hens in each coop. If two males are put together during breeding time, it is only a question of time when but one is left. The lack of fertility was probably due to overfeeding, or not giving enough green food in the beginning of the breeding season, or perhaps because the birds were young.

MR. E. A. BRACKETT.

DEAR SIR : — We received a trio of Mongolian pheasants from you last fall. In the spring the cock wilfully and intentionally committed assault and battery on one of the hens, and we took her out of the coop and asked you for another cock. However, before he arrived the hen had passed in her checks, and by your advice we liberated the cock. He has been seen, at times, all summer.

Our hen laid thirty-two eggs, from which were hatched twelve chicks. The first three were hatched when the weather was so cool that it was impossible to get maggots for food, and we lost two. From the next

sixteen eggs we had nine chicks, seven of which escaped when about a quarter grown. The three remaining were fine, healthy cocks (don't mate up well, however) until Thanksgiving Day, when one died. Can you let us have some hens later? We now have the old pair, the pair received this fall from Senator Bill, and two young cocks, — six good, healthy birds. We intend to breed them another season and hope to raise the young and select several pairs for other pens. The birds that are loose have been seen around the town, and it looks as if they can live nicely in this climate.

Yours respectfully,

FORREST W. W. FORBES.

WESTBOROUGH, MASS., December, 1896.

In the spring of 1895 Mr. F. G. Crane of Dalton put into the woods and covers of that town twelve pheasants, which were without doubt of the Mongolian breed. Most of them lived through the winter, and a number of broods were hatched and raised during the summer. We thus have good proof that the pheasant will live and thrive in this part of the State, which has the most trying climate.

The sentiment is very strong in this locality, that it is wise for the State to encourage and aid in the propagation of these birds.

BENJ. SMITH, *Deputy*.

PITTSFIELD.

Report for the Fitchburg Gun and Rifle Club.

Mr. E. A. BRACKETT.

DEAR SIR: — Last spring the members of the Fitchburg Gun and Rifle Club desired me to take charge of rearing Mongolian pheasants from eggs to be furnished by you. Although not a sportsman, they succeeded in interesting me in this matter, and I have done my best to work for the interest of the club and State. I began by visiting your yards at Winchester and listening carefully to your directions for hatching and rearing the young birds, and brought home with me twenty-six eggs, which were given to two buff bantam hens, and twenty-two chicks were hatched. I had maggots ready to feed to them, but lost many the first ten days. Three of them, one cock and two hens, grew to maturity, and beautiful specimens they are. Of the second lot of twenty-six eggs, set late in June, twenty were hatched. These were with two bantam hens, ten chicks each. I tried to profit by my first experience, but in twelve days had but ten. The hens were fed in separate pens from the chicks, but one was so loyal that she would carry over the partition bits of food, which sickened the little pheasants before I knew what she was up to. I carefully examined each one that died, and found that any particle of grain

would lodge in the little gizzard so hard there would not be room enough for the sharp grit to grind it. I am sure that care must be observed that the little birds get only maggots, or such food, for at least ten days. Nine of these chicks survived. The rearing yards were in an apple orchard after the grass was cut, and the birds were allowed to roam at will after the hens left them, as we understood that you favored that plan, and part of them are still at large. Those that have been caught are much finer birds than they would have been had they been shut in when young.

The club have provided suitable breeding pens for twelve or fifteen birds, and are anxious to do all in their power to help the State in stocking the woods with these beautiful birds.

Respectfully yours,

H. R. FOSTER.

ASHBY, MASS., Dec. 9, 1896.

NORTH EASTON, MASS., Dec. 2, 1896.

Mr. E. A. BRACKETT.

DEAR SIR:—Yours of the 30th received. I have now about forty pheasants, but unfortunately a large proportion of them are cocks. Since I adopted your method of feeding the young birds I have not lost any from sickness. I lost a good many the first part of the hatching season, on account of not having the proper hens. I was unable to get Pekin bantams, and the hens I had would pick the young birds as soon as they were hatched, and in that way I lost thirty, besides nearly as many from being trampled on.

The last part of the time I took the young birds away from the hens as soon as hatched, and put them into a brooder, and from that time hardly lost a bird. I feel very much encouraged, and am sure that, if I could have followed your methods as published in your 1895 report to the letter, I should have had a great many more birds, but I could not get any Pekin bantams when I needed them. Last year, out of about the same number of eggs hatched out as this year, I only raised two birds; so we see that the feeding was responsible, in a great measure, for my success this year.

The birds I turned out a year ago last spring have done remarkably well. I have seen three broods of young birds, and have heard of others. They are the English ring-neck.

I hope to raise a great many more birds next spring than I did this year, and therefore shall not turn out those I raised this year, but keep them for layers, and hope next year to turn out a great many. I hope you will be able to let me have a few hens, as I have not enough to do as I should like to. I shall try to go to Winchester very soon and talk the matter over.

Yours truly,

HOBART AMES.

Mr. Ames has a large plant, fully equipped for raising pheasants for stocking his vicinity. Last spring he bought two pairs of Mongolian pheasants and received two settings of eggs from the State, and is pursuing the work with a perseverance and energy which cannot fail to give excellent results. We had the pleasure of visiting his aviaries and looking over the arrangements and plans which he has so intelligently laid out.

The perversity of the large hens in killing the chickens was not an entire misfortune, as it induced him to use the brooder as soon as they were hatched, thereby saving his birds. From his and our own experience with the brooder, the indications are that more birds can be raised in that way than by trusting them to the care of even the best of hens. Where a large number of birds are to be raised, if the incubator and brooder can be successfully substituted for hens, nine-tenths of the expense and labor will be saved.

The price usually asked for brooders is altogether too large, as they can be built cheaper. A boiler, three feet six inches long and one foot wide, made of galvanized iron, can be made for five dollars, and of copper for six dollars, and any one who can use a saw and plane can make the woodwork. The selling price of most of them is twenty-five dollars. The best brooder boiler we have seen for out-door work is one invented and made by Mr. Harlow Foster, Ashby, Mass., who has been engaged by the Fitchburg club to raise pheasants for them.

Twenty-three applications for pheasants have been received this year from parties who have built aviaries, and are prepared to either breed them or take the young birds, care for them through the winter and liberate them in the spring. But, owing to the fact that the most of those who had birds last year were unsuccessful in breeding them, it is thought best to increase the State plant, so as to be able to send out a larger number of young birds next fall. In order to carry out this plan, ten new coops have been built, which will necessitate the retention of a large number of breeders. This, with the fact that a large proportion of the young birds are males, precludes the possibility of filling all of the applications this year.

As the only way now known of raising young Mongolian pheasants is by feeding them on the larvæ of the fly, the successful raising of this food is a matter requiring quite as much

care, attention and study as any other department of pheasantry. The chicks must have soft food until they are at least three weeks old, as their digestive system is too weak to make use of anything else. In ninety-nine cases out of a hundred, when the young birds sicken and die, an examination of the gizzard will show that this organ is crowded with food which it is too weak to take care of.

Flies do not lay their eggs on decayed meat. It is a slightly tainted condition, which lasts from twenty-four to thirty-six hours, according to the weather, that they make use of. They hatch in about twenty-four hours, and feed on the decaying meat. This is the natural order, and is generally supposed to be necessary to their growth. When a large quantity of meat is used it becomes very offensive, and necessitates the removal of the house for the production of the maggots to some out-of-the-way place. To obviate this, the following arrangement has been adopted at the State aviary. The plucks are received fresh, and put into the refrigerator. Only the lights are used for the flies to blow. As the eggs are usually deposited in clusters, they are cut out with a sharp knife (with a small piece of the lights), and these pieces are placed in the hoppers about half full of moist wheat bran, as described in last year's report. In a short time they work their way down into the drawers below, which have the moist bran about an inch deep over the bottom, overlaid with thin slices of meat (cut from the plucks). They are fed this way night and morning, until they are full grown. Before the meat has time to decay, they have eaten it all. So far from putrid meat being necessary, it is found that they thrive better on fresh meat, are larger and better for the young birds.

In our last report it was stated that the only chance of failure in the introduction of these birds was the possibility that they might not find sufficient food to tide them over the deep snows, but we have now abundant evidence that they have not perished either from cold or lack of food. Of those that were released or escaped from us last year, two are known to have been killed by foxes and several shot by reckless hunters, against one of whom a warrant is out for his arrest. During the summer nests were found and young broods seen in Winchester and vicinity. One hen, with a brood of half-grown

chicks, was seen just outside of the aviary, and males were frequently seen in the adjoining grounds.

No one can mistake a cock for a hen, and, as they are polygamous, it is to be hoped that, should they become abundant, the time will never come when the law will allow the killing of the female.

Our experience and observations confirm the statement from Oregon that they are a valuable acquisition in the preservation of our crops.

GAME.

Reports from our deputies and other reliable sources show a still further decrease in our game birds. Especially is this true in the eastern and middle sections of the State. This depletion is due to overshooting and that most destructive of all weapons, the snare. In some sections snares have been set by the thousands, completely clearing out the ruffed grouse, and, if this nefarious work is not stopped, this finest of game birds will be entirely destroyed. It seems useless for the State to expend money for the protection of game unless this work can be suppressed. All snaring should be prohibited, under severe penalty of fine or imprisonment or both, at the discretion of the court. All sportsmen and all persons who wish to see our game protected should unite in the effort to obtain a law to prevent this wholesale destruction. As the law now stands, it is almost impossible to convict any one of snaring.

The time in which game can be killed should be shortened, and the open season for all game be the same. Unless some decided action is taken, there will be in the near future no game in our woods and fields.

As to song and insectivorous birds, the laws should be more vigorously enforced. Now, any boy who can raise \$1.50 to buy an old Springfield musket, considers himself privileged to take any wild thing he sees for a target. This, together with the fashion of decorating ladies' hats with skins and wings of birds, has led to the depletion of insectivorous birds to such a degree that scarcely a crop of any kind can be raised without spraying with poison to kill the insects which were formerly kept in check by the birds. The penalty for this destruction of the balance of nature is everywhere apparent, and the horti-

culturist and farmer are heavily taxed for want of foresight in protecting their own interests.

If the destruction of these birds cannot be otherwise restrained, let the law for their protection extend to "the possession of their skins or any part thereof," except for scientific purposes.

In some States it is the duty of every teacher to instruct the children in the importance of preserving the birds. Let us hope that something of the kind may be adopted by our Board of Education.

There are a number of deputies, who are appointed at the request of the selectmen of the towns where they reside, or on the petition of fish and game associations. A majority of these men are serving without pay, and cannot afford to act beyond their immediate neighborhoods. Following the example of other States, we recommend that there should be a paid deputy in each county, who shall give attention to any violation of the fish and game laws.

We recommend the rebuilding of the Winchester hatchery; that the Lawrence fishway be repaired; that the open season for all game be uniform, and the time be limited to two months; that, for a term of five years, the sale of game killed in this State be prohibited; and that there should be additional laws for the protection of our lobsters.

Deer are coming into the State in considerable numbers, and, as the present law allows them to be killed during the month of November, except on the Cape, we recommend that it be changed so as to protect them throughout the State for a term of years.

E. A. BRACKETT,
I. C. YOUNG,
E. D. BUFFINGTON,

Commissioners on Inland Fisheries and Game.

APPENDIX.

[A.]

LIST OF FISH COMMISSIONERS.

THE UNITED STATES.

Commissioner, John J. Brice, Washington, D. C.
Irving H. Dunlap, Chief Clerk.
W. de C. Ravenal, Assistant in charge of Division of Fish Culture.
Richard Rathbun, Assistant in charge of Division of Scientific Inquiry.
Hugh M. Smith, Assistant in charge of Division of Fisheries.

ALABAMA.

Col. D. R. Hundley, Madison.
Chas. S. G. Doster, Prattville.

ARKANSAS.

H. H. Rottaken, Little Rock.
W. B. Worthen, Little Rock.

CALIFORNIA.

H. F. Emeric, San Francisco.
Alex. T. Vogelsang, San Francisco.
J. M. Morrison, Sacramento.
Address, California Fish Commission, 78 Flood Building, San Francisco, Cal.

COLORADO.

Gordon Land, Denver.

CONNECTICUT.

Hubert Williams, President, Salisbury (Lakeville P.O.)
Abbott C. Collins, Secretary, Hartford.
James A. Bill, Treasurer, Lyme (Bill Hill P.O.)

DELAWARE.

A. B. Short, Milford.
Dr. E. B. Shortlidge, Supt. of Hatcheries, Wilmington.

GEORGIA.

R. T. Nesbitt, Commissioner of Agriculture, Atlanta.
Capt. J. D. Edmondson, Supt. of Fisheries, La Grange.

ILLINOIS.

Richard Roe,	.	.	.	.	.	East St. Louis.
Henry Schmidt,	Elgin.
S. P. Bartlett, Superintendent,	Quincy.

INDIANA.

P. H. Kirsch,	Columbia City.
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IOWA.

Geo. E. Delevan,	Estherville.
Ole Bjorenson, Superintendent,	

KANSAS.

O. E. Sadler,	El Dorado.
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MAINE.

L. T. Carleton,	Augusta.
Henry O. Stanley,	Dixfield.
Charles E. Oak,	Caribou.
O. B. Whitten, Sea and Shore Fisheries,	.	.	.	.	.	Portland.

MARYLAND.

James C. Tawes, East Shore,	.	.	.	.	Crisfield.
John E. Gnagey, West Shore,	.	.	.	.	Accident.

MASSACHUSETTS.

E. A. Brackett,	.	.	.	.	.	Winchester.
I. C. Young,	.	.	.	.	.	Wellfleet.
E. D. Buffington,	.	.	.	.	.	Worcester.

MICHIGAN.

Herschel Whittaker, President,	.	.	.	.	.	Detroit.
H. W. Davis,	.	.	.	.	.	Grand Rapids.
F. B. Dickerson,	.	.	.	.	.	Detroit.
A. Ives, Jr.,	.	.	.	.	.	Detroit.
Geo. D. Mussey, Secretary,	.	.	.	.	.	Detroit.
Seymour Bower, Superintendent,	.	.	.	.	.	Detroit.
Office, 78 Moffett Building,	.	.	.	.	.	Detroit.

MINNESOTA.

W. S. Timberlake,	.	.	.	.	.	St. Paul.
Wm. Bird,	.	.	.	.	.	Fairmount.
A. F. Ferris, Treasurer,	.	.	.	.	.	Brainerd.
F. von Baumbach, Secretary,	.	.	.	.	.	Alexandria.
S. S. Watkins, Superintendent,	.	.	.	.	.	St. Paul.
S. F. Fullerton, Executive Agent,	.	.	.	.	.	Duluth.

MISSOURI.

John T. Crisp, Chairman,	. . . . .	Independence.
James L. Griswold,	. . . . .	St. Louis.
E. A. Donnelan,	. . . . .	St. Joseph.
N. B. Crisp, Secretary,	. . . . .	Independence.

NEBRASKA.

J. S. Kilpatrick,	. . . . .	Lincoln.
Wm. L. May,	. . . . .	Omaha.
Rob't S. Oberfelder,	. . . . .	Sidney.
M. E. O'Brien, Supt. of Hatcheries,	. . . . .	South Bend.

NEVADA.

Geo. T. Mills,	. . . . .	Carson City.
F. C. Boyce, Superintendent of Hatcheries,		Carson City.

NEW HAMPSHIRE.

W. T. Shurtleff,	. . . . .	Lancaster.
F. L. Hughes,	. . . . .	Ashland.
Nath'l Wentworth,	. . . . .	Hudson.

NEW JERSEY.

Geo. Pfeiffer, Jr.,	. . . . .	Camden.
H. P. Frothingham,	. . . . .	Mt. Arlington.
P. W. Page,	. . . . .	Summit.

NEW YORK.

Barnet H. Davis, President,	. . . . .	Palmyra.
Hendrick S. Holden,	. . . . .	Syracuse
Wm. R. Weed,	. . . . .	Potsdam.
Cha's H. Babcock,	. . . . .	Rochester.
Edward Thompson,	. . . . .	Northport, L.I.
Charles A. Taylor, Assistant Secretary,	. . . . .	Albany.

OHIO.

Geo. Falloon, President,	. . . . .	Athens.
B. F. Seitner, Secretary,	. . . . .	Dayton.
E. H. Shorb,	. . . . .	Van Wert.
Albert Brewer,	Tiffin.
J. W. Owens,	Newark.

OREGON.

H. D. M'Guire, Fish and Game Protector,	Portland.
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PENNSYLVANIA.

S. B. Stillwell, President, Scranton.
 H. C. Demuth, Lancaster.
 James A. Dale, York.
 Louis Streuber, Erie.
 D. P. Corwin, Secretary, 413 Wood Street, Pittsburg.
 Jas. W. Correll, Easton.

PENNSYLVANIA GAME COMMISSION.

Coleman K. Sober, Lewisburg.
 Wm. M. Kennedy, Allegheny City.
 E. B. Westfall, Williamsport.
 James H. Worden, Harrisburg.
 J. A. Stearns, Wilkesbarre.
 Charles Haebner, Philadelphia.

RHODE ISLAND.

J. M. K. Southwick, Newport.
 Wm. P. Morton, Johnstown.
 H. T. Root, Providence.
 C. W. Willard, Westerly.
 A. D. Roberts, Woonsocket.

SOUTH CAROLINA.

Hon. A. P. Butler, Columbia.

TENNESSEE.

W. W. McDowell, Memphis.
 H. H. Sneed, Chattanooga.
 Edw. D. Hicks, Nashville.

UTAH.

John Sharp, Warden, Salt Lake City.

VERMONT.

John W. Titcomb, St. Johnsbury.
 Horace W. Bailey, Newbury.

VIRGINIA.

Dr. J. T. Wilkins, Bridgetown.

WASHINGTON.

James Crawford, Vancouver.
 — Bowdman, Game Warden, Seattle.

WISCONSIN.

Edwin E. Bryant, President,	.	.	.	Madison.
Calvert Spensley,	.	.	.	Mineral Point.
Jas. J. Hogan,	.	.	.	LaCrosse.
Wm. J. Starr,	.	.	.	Eau Claire.
Currie G. Bell,	.	.	.	Bayfield.
Dr. E. A. Birge,	.	.	.	Madison.
Henry D. Smith,	.	.	.	Appleton.
Jas. Nevin, Superintendent,	.	.	.	Madison.

WYOMING.

Louis Miller,	.	.	.	Laramie.
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[B.]

LIST OF PONDS LEASED

By the Commissioners on Inland Fisheries, under Authority given by Chap. 384, Sect. 9, of the Acts of 1869.

1877.

- Oct. 1. Fort, Great Spectacle and Little Spectacle ponds, in Lancaster, to inhabitants of Lancaster, 20 years.

1879.

- July 1. Fresh Pond, in Falmouth, to Thomas H. Lawrence, 20 years.

1882.

- March 1. Blair's Pond, in Blandford, to Curtis M. Blair and another, 15 years.
- April 1. Ward Pond, *alias* Wightman Pond, in Ashburnham, to Herbert F. Rockwood and another, 15 years.
- May 1. Horn Pond, in Woburn, to inhabitants of Woburn, 15 years.
- June 1. Wickaboag Pond, in West Brookfield, to inhabitants of West Brookfield, 15 years.

1883.

- April 6. Fresh Pond, in Tisbury, to Allen Look and others, 15 years.
23. Keyes Pond, in Westford, to M. H. A. Evans, 15 years.
- May 8. Singletary Pond, in Sutton and Millbury, to towns of Sutton and Millbury, 15 years.
7. The Great Pond, in Ashfield, to town of Ashfield, 15 years.

1884.

- July 17. Farm Pond, in Cottage City, to John C. Hamblin and others, 15 years.
- Aug. 30. Sand Pond, in Ayer, to inhabitants of Ayer, 15 years.
- Sept. 5. Great Pond, in North Andover, to inhabitants of North Andover, 15 years.

[C.]

DISTRIBUTION OF TROUT FRY, 1896.

Barnstable, Bristol and Plymouth Counties.

John Nicholson, for waters in Hyannis.

Israel Crocker, for waters in Hyannis.

A. S. Backus, for waters in Barnstable.

H. S. Perkins, for waters in Bridgewater.

Nathan Everett, for waters in Fall River.

Essex County.

1 Oscar Stowell, for waters in Lynnfield.

J. A. Blake, for waters in Ipswich.

A. L. Clark, for waters in Ipswich.

J. H. Blake, for waters in Ipswich.

A. I. Savory, for waters in Ipswich.

Wm. H. Hills, for waters in Ipswich.

J. G. Sperling, for waters in Ipswich.

A. B. Clark, for waters in Ipswich.

H. W. Peabody, for waters in Beverly.

Seth Clothey, for waters in Peabody.

Geo. H. Webster, for waters in Haverhill.

C. N. Murray, for waters in Bradford.

Middlesex County.

Caleb Smith, for waters in Chelmsford.

Wm. A. Lang, for waters in Chelmsford.

G. A. Coburn, for waters in Chelmsford.

Daniel Going, for waters in Wilmington.

J. C. Hartshorne, for waters in Wakefield.

Waldo Spaulding, for waters in Townsend Harbor.

G. H. Maynard, for waters in Hudson.

C. F. Clark, for waters in Sudbury.

W. Messenger, for waters in Melrose.

C. A. Jones, for waters in Woburn.

Worcester County.

G. N. Dyer, for waters in Gardner.

O. O. Oliver, for waters in Templeton.

J. W. Fairbanks, for waters in Westborough.

F. W. Forbes, for waters in Westborough.

I. N. Keyes, for waters in Paxton.

Ledyard Bill, for waters in Paxton.

C. L. Allen, for waters in Worcester.

A. S. Lowell, for waters in Worcester.

J. F. Cumming, for waters in Boylston.

C. F. Rice, for waters in Grafton.

R. B. Dodge, for waters in Charlton.

C. V. Dudley, for waters in Northbridge.

F. N. Eddy, for waters in Paxton.

T. P. Brown, for waters in Rutland.

G. W. Cook, *et al.*, for waters in Barre.

B. F. Brooks, *et al.*, for waters in Barre.

S. C. Perham, for waters in Peter-sham.

C. W. Bates, *et al.*, for waters in Phillipston.

C. E. Fay, for waters in Northboro.

Chas. Hill, *et al.*, for waters in Webster.

Hampden and Hampshire Counties.

A. J. Northrup, for waters in Monson.

W. H. Brainerd, for waters in Palmer.

H. C. Mabie, for waters in North-field.

Berkshire County.

Fred. W. Champney, *et al.*, for waters in North Adams.

C. W. Burton, for waters in Cheshire.

W. S. Jenks, for waters in Savoy.

J. B. Richmond, for waters in Adams.

Henry Horburgh, for waters in Hinsdale and Windsor.

J. M. Stevenson, for waters in Pittsfield.

J. H. Wood, for waters in Dalton.

F. G. Crane, for waters in Dalton.

G. K. Baird, for waters in Tyringham.

E. J. Noble, for waters in Windsor.

[D.]

FISH SEEN IN THE LAWRENCE FISHWAY IN THE
SEASON OF 1896.

LAWRENCE, Oct. 7, 1896.

EDWARD A. BRACKETT.

DEAR SIR:—I enclose my report of fish seen here at Lawrence this season. I doubt if I see any more salmon this season; I certainly shall not unless the river is much higher than it is now. Probably when the river does rise it will come so high that I cannot see the fish, unless I should see one trying to jump the dam, or they should get into that pool at the foot of the dam, and be left there by receding water. If I see any, I will write you at once, so it can be added to report.

Fish seen in the Merrimac River, near the Fishway, at Lawrence in 1896.

The first of March the Merrimac River was higher than it has been any year before since the Lawrence dam was built. The river was full of great cakes of ice, uprooted trees, logs, etc. When the water went down, about a third of the fishway, at the upper end, was completely torn away. The high water flooded the lower floors of many of the mills; at one mill it filled a lot of large tubs used in bleaching. When the water went down, a large number of suckers and chubbs were found in the tubs. This shows that these fish run up the river very early in the season.

Lampreys appeared at the fishway, hanging onto the rocks, about the first of May. They increased in numbers very fast, and from the 10th to the 20th of June there were hundreds of them struggling up over the rocks, as far up as there was any water to cover them. They all disappeared about the first of July. I thought they had all run up into a big pool at the south end of the dam, but I found none there when the water fell off so that I could draw a net through the pool.

Salmon were seen jumping at the foot of the dam June 10, and nearly every day until the water got so low that very little came over the dam.

There were a lot of salmon in the pool mentioned above from the 25th of June until the 25th of July. They were seen, by a large number of persons, trying to jump up the dam. They were counted at different times, the count varying from ten to twenty. This pool acted as a kind of trap. When there was a good body of water coming over the dam, it was easy for the salmon to swim up into it; but when there was no water coming over the dam, the salmon could not get out down the river. I attempted to take the salmon out of the pool July 24, but the water was so deep I could not get them. July 25, with the aid of four men and a seine, I took ten salmon out of the pool and put them in the river above. Since that time, have seen no salmon. Have seen a few suckers, chubbs and hornpouts that struggled up into the pool.

THOMAS S. HOLMES, *Deputy,*
In charge of Lawrence Fishway.

[E.]

REPORTS OF DEPUTIES.

MARION, Dec. 13, 1896.

Commissioners on Inland Fisheries and Game.

GENTLEMEN: — In submitting my report, I can say that, while there have been more violations of the fish and game laws during the year than usual, the violations have been looked after very closely, and several parties have been taken into the courts and paid the penalty of their offenses, as the following will show: April 13, in connection with officers Proctor and Rhodes, convicted parties in Weymouth for seining smelt; amount of fines imposed and paid, \$114. May 6, convicted parties in New Bedford for having in possession short lobsters; amount of fines imposed, \$250; being unable to pay fine, both were sent to jail for three months. May 18, in connection with officer Proctor and others, convicted fifteen men from Dartmouth and surrounding towns for shooting coot; amount of fines imposed and paid, \$290. August 10, convicted Jose Alberto of Paddocks Island for having in his possession short lobsters; amount of fine imposed and paid, \$40. August 13 and 15, in connection with officer Proctor, convicted parties on Long Island and at Revere for short lobsters; all appealed to superior court, pleaded guilty and paid fines amounting to \$280.

Several complaints of snaring have been made, and considerable time has been spent in looking after them, but have been unable to get any convictions. In tabulating the returns from the pounds and net fishermen, I find an increase of forty-two over last year; and, while the totals show a large increase in the catch of alewives, scup, squeteague, mackerel, bluefish and others, they also show a large falling off in the catch of other kinds, and as a whole do not compare favorably with last year.

In my report of two years ago I called your attention to the falling off in the catch of lobsters; this year we have received returns from 453 fishermen, the largest I think ever reported before, and, while the total catch is larger than last year, the catch per pot for 1896 has

fallen below the catch of 1895 at least 10 per cent. The decrease in the catch of lobsters per pot has fallen from 82 per cent. in 1890 to 45 per cent. in 1896. Some method should be adopted regulating the catching, so that the supply can be kept up, and at the same time be a business of profit to the fishermen catching them. The price of lobster has already got beyond the reach of the average man, and, unless stringent measures are adopted, will in time become as extinct as by overfishing was that mighty roamer of the deep that swallowed Jonah.

JOHN W. DELANO,
Deputy.

E. A. BRACKETT, *Chairman of Commissioners on Inland Fisheries and Game.*

DEAR SIR:—I have patrolled the south-eastern coast of Massachusetts in the steamer "Ocean Gem" from May 16 to October 8, ninety-one days of which were spent in Buzzard's Bay.

Menhaden were plentiful in said bay during the summer months, and left about the first of October.

There was only one violation of the seining law, to my knowledge, and the party was arrested and convicted. The fishermen seem determined to violate the lobster law, and continue to secrete the little ones and dispose of them, regardless of the consequences.

It is very difficult to enforce the present lobster law, as the fishermen put the little ones in a car or bag as soon as they catch them, and when anybody attempts to go near them said crates or bags are pushed overboard. I have seen thousands of small lobsters thrown into the water during the past summer, on the approach of the steamer "Ocean Gem," said lobsters being confined in crates in such a manner that they could not escape, and would consequently die.

Another violation of importance, to which I wish to call attention, is the snaring of game birds. There are men in this State who make a business of snaring, using thousands of snares, made for that purpose, of very fine copper wire.

These people leave their snares set after they get through tending them, and said snares for months destroy birds that are not of any use to anybody.

Unless this business is stopped, I think the ruffed grouse will soon be a rare bird in this State.

I have made 64 arrests and got 63 convictions; seized 11,372 short lobsters and planted 1,500,000 eggs. Amount of fines imposed by the courts, \$3,614.50.

Respectfully,

W. H. PROCTOR,
District Police Officer.

BRADFORD, Nov. 14, 1896.

Commissioners on Inland Fisheries and Game.

GENTLEMEN : — I respectfully submit the following as the results of my work in enforcing the fish and game laws for the season of 1896. In June complaints were sent me from Rockport, Gloucester and Manchester, of several persons being engaged in catching and selling short lobsters. I investigated the complaints, and found that a party from Salem was furnishing outfits for the catchers at Manchester to carry on the business in a regular, systematic way. The catchers would sink the short lobsters in small cars, then those who furnished the outfit would visit the cars and carry the lobsters to such places for a market as best suited their convenience. As the carrying away of the lobsters was done early in the morning or in the night, there seemed to be comparatively but few chances of their being detected. I was, however, able to secure the arrest of eight persons from the above-named places, engaged in handling short lobsters; seven of them were convicted, and fined. I have arrested seven persons for shooting and fishing on the Lord's Day, all of whom were convicted. Two men were found guilty of using a set net in a pond, and fined \$20. I also arrested a party for peddling lobsters from a cart on the Lord's Day; fined \$10. Number of arrests, 18; total amount of fines as imposed in lower courts, \$3,000. There are now pending in the superior court three cases, the fines of which amount to \$1,900. Seven cars, containing 760 short lobsters, were seized, the cars were destroyed and the lobsters liberated.

There have been no complaints of snaring partridges in towns where so many have been taken in previous seasons. I am told that persons formerly engaged in snaring partridges have been forced to seek other employment, from the fact that partridges are so scarce it is no longer profitable to attempt to take them by means of snares.

Respectfully submitted,

B. P. CHADWICK,

Deputy Commissioner.

PITTSFIELD, MASS., Dec. 1, 1896.

Mr. EDWARD A. BRACKETT, *Chairman Commissioners on Inland Fisheries and Game.*

DEAR SIR : — I have to report for the western part of the State, that for our trout fishing we have not for many seasons had better catches, especially in size. A great many large ones have been caught, and our sportsmen say fishing has been good, considering the number of fishermen.

For birds, woodcock were not very plenty, but partridge shooting has been good, never better than at the first of the season, but snares have hurt us some. If it were not for the pot hunters, we could not ask for better sport than we have in this part of the State.

Complaints come in from all directions, and I have done the best I could to follow them up for the purpose of enforcing the laws for the protection of fish and game. Arrests made by me have been nine in number, as follows: two for taking trout out of season, one for shooting game out of season, four for Sunday shooting and two for using dynamite in Onota Lake. Of these, five were convicted and paid fines, and two more have the charges held over them.

I have taken up eleven set lines, two from Round Pond in Berkshire, four from Cheshire reservoir, three from Onota Lake, one from Pontoosuc Lake and one from Saw-mill Pond in Berkshire. Found one trap for catching trout in stream, which I destroyed, and have taken up about one hundred snares. Worked with a New York State deputy, and captured two men who were snaring birds and shipping them into this State for market. Found several small lobsters in one of the markets, which were alive, and proprietor said he would ship them back to Boston. I have served papers on three mill owners for depositing sawdust in streams, one at Becket Centre and two in town of New Marlborough.

In the spring of 1895 Mr. F. G. Crane of Dalton put into the woods and covers of that town twelve pheasants, which were without doubt of the Mongolian breed. Most of them lived through the winter, and a number of broods were hatched and raised during the summer. We thus have good proof that the pheasant will live and thrive in this part of the State, which has the most trying climate of any. The sentiment is so very strong in this locality that it is wise for the State to encourage and aid the propagation of these birds.

The Follett case, which has been reported twice before, is still unsettled. It was supposed, when the supreme court overruled the defendants' exceptions in September, 1895, that the fine would be paid without further delay. This did not prove to be true, as a motion was filed at the superior court term in January of this year for continuance of sentence, on the ground, as near as I can learn, that the court erred in not stating under which of the three counts sentence was given. This motion was denied and appeal made to the supreme court. District Attorney Gardner has continued to show his determination to prosecute the case, and see that the sentence is carried out. I have no doubt of his success, though it may take some time to bring it about.

Respectfully submitted,

BENJAMIN SMITH,
Deputy Commissioner.

Hon. E. A. BRACKETT, *Chairman Commissioners of Inland Fisheries and Game.*

DEAR SIR:—My commission as deputy was received August 25, last, and since that date I have been at work every day the weather has permitted. My expenses have been paid by the Rod and Gun Club of Massachusetts, with headquarters in Boston.

I have made two convictions for violations of the snaring laws. Clarence Hattenburg of North Easton for snaring two ruffed grouse, and Harvey Hunter of Wendell for setting snares, for snaring two grouse, for snaring three grouse and for snaring two rabbits. Since receiving my commission I have also advised twelve men found out in the woods before the law was off to go home; also stopped one party fishing with set lines, and destroyed over three thousand snares in different portions of the State.

My journal from August 20 to November 25 is hereto attached.

Very truly yours,

W. E. QUIGGLE.

Boston, Dec. 11, 1896.

Report of Warden.

Aug. 20–27. In Boston, learning duties and gathering information; also each day took a short trip in the country, and sent home six persons who were out with guns; could not arrest, not having qualified.

Wilmington and Tewksbury. Sent home one gunner seen shooting, not being qualified to arrest.

28. Qualified as deputy. Went from Canton Junction to Dedham. No gunning heard or seen.

29. Rain.

30. Dedham, Needham, West Dedham to Dedham Road. Stopped party fishing with set lines, and sent home four men with guns.

31. Winchester to see Commissioner Brackett.

Sept.

1. Boston getting information.

2. Sharon to Canton Junction, Dedham Road and Dedham.

3. Sharon and Readville.

4. Dedham. Sent home one man with gun, but no evidence of shooting, so could not arrest.

5. Canton and Dedham. (The past four days being to put a stop to a party of three who make a practice of shooting before the law goes off. Found them in the woods, but no evidence to convict or arrest.)

6. Rain.

7. Sharon. Complaint of quail shooting unfounded.

8. Boston.

9. Rain.

10. Rain.

- Sept. 11, 12. Middleton, Topsfield and Boxford, after snarers; found old snares, but not set this season.
13. Canton. Heard one party shooting, but could not find him.
- 14-18. Easton, on snaring complaint; about two hundred snares in the town. Saw one person set snare, but did not arrest, preferring to wait till arrest could be had for the bird.
19. Back to Boston for a few days, as it had become known that enforcement of the snaring law was to be made.
20. Rain.
21. Rain.
- 22-25. Easton, and took help to act as witness. Went over all the country, locating snares, and found two birds in a hedge of seven snares. Laid all day from daybreak to dark, with witness also.
26. Laid from daybreak till about 1.50 P.M., when a person (Clarence Hattenburg) came, took both birds out and reset the snares, when he was arrested. Took him to North Easton, swore out warrant, and he was put under bail to appear at Taunton on 28th.
28. Took witness and appeared at court in Taunton, where Hattenburg pleaded guilty and was fined \$20.
29. Walpole and East Walpole. Complaint of quail shooting unfounded.
- Oct. 2-12. Walpole, part of Foxborough, Milford, Norfolk, Bellingham and Uxbridge. At last place some snaring is done.
- 13-17. Mansfield and Foxborough. Not a snare tended since last visit.
19. Went to Orange.
20. Hunting snares.
21. Rain.
22. Found about one dozen snares.
24. Moved to Warwick; found about seventy-five snares.
26. Sent skeleton to Boston; found new line of snares.
28. Found new line of snares and one snared partridge.
31. Rain past three days; more snares found; moved to Wendell.
- Nov. 1. Snares found towards Northfield.
2. New snares found towards Northfield; two partridges in snares.
6. Rain past two days; found two partridges and one rabbit in snares; traced snares as far as Northfield mountain; now tending four lines of snares.
10. Saw a man setting snares.
- 11-14. Now watching five partridges, two rabbits and one squirrel in snares; zero weather.
15. Case given away.
18. Have laid by the snares five days; not visited by any one.
21. Snowstorm; thermometer almost to zero.
23. Went to Greenfield, swore out warrant, and Deputy Sheriff Fowler arrested Harvey Hunter of Orange.

- Nov. 24. Attended court at Orange before Judge Dana. Hunter found guilty on four counts: for setting snares; for snaring two partridges; for snaring three partridges; for snaring two rabbits; fined \$20 and costs on first count, the other three held in suspense, under promise to obey the law.
25. Came home.

MILFORD, MASS., Nov. 9, 1896.

Mr. E. A. BRACKETT, *Chairman Commissioners on Inland Fisheries and Game.*

DEAR SIR: — In submitting my annual report I will say that partridge and quail have been quite plenty, but have decreased fast in a very short time, owing to those who make a practice of shooting for the market.

I suggested once before, and repeat it, that the season should be shortened to two months, from October 1 to December 1, on both quail and partridge. My reason for it is this: the birds would be in better condition, full grown, and so many would not be killed off.

In one market in this town something over three hundred birds were sent out last year, and in one day of this year sixty were sent from the same place. That will give one some idea of the number of birds shot in one place for the market.

Quail are plenty, but small; woodcock scarce.

Relative to violating the law, I have had very few complaints; the Sunday law is broken most frequently. Have been on the lookout for offenders. Those suspected have been notified that if caught they would be prosecuted, and that, with the posters, has prevented, I think, much illegal hunting and fishing.

Respectfully yours,

MORTIMER EDWARDS,
Deputy.

MILFORD, MASS., Nov. 9, 1896.

To Hon. E. A. BRACKETT, *Chairman of Commissioners of Massachusetts Inland Fisheries and Game.*

DEAR SIR: — I have the pleasure of saying in this, my first report, that game, in my opinion, is very plenty, especially partridges. There are some quail in this section, but not as many as a few years ago. Now I would like to see this change made in the game laws: Open season to begin October 1 or 15 (on all game at the same time), and close December 15, with a clause making Sundays part of the close season. There are some persons who are bound to hunt on Sunday, and if they were fined for the birds as well as for Sabbath

day shooting, they might stop it. There have been no arrests here this season for violating the game law, but as there is a large territory, no doubt there were some birds killed out of season.

The Mongolian pheasants are feathering out finely and are getting quite tame compared with what they were when they first came.

Yours respectfully,

WM. N. PRENTISS.

P. O. Box 815, MILFORD, MASS.

BRAINTREE, MASS., Nov. 10, 1896.

MR. EDWARD A. BRACKETT, *Chairman of the Commissioners on Inland Fisheries and Game.*

DEAR SIR:—I received the appointment of deputy commissioner, dated April 18, 1896, and in compliance with said appointment I make the following report.

I am located at the head of navigation, where the Monatiquot River empties into the salt water.

Smelts and alewives have been very numerous this season in the Monatiquot River and Smelt Brook, also at East Weymouth, in Back River, so called. This is due largely to the East Weymouth Fish and Game Club. Since the formation of this club the violators of the fish and game laws have been watched day and night during the spawning season, and this has had its good effect. A great deal of credit should be given this club.

I have made it my special duty to look after the fishways. I see that they are put in order before the fish begin to run, and that they are kept in good order during the spawning season. The great trouble has been to keep the boys out of the fishways. The mill owners on the stream do not bother themselves about keeping the violators away from the fishways; and the local officers, in order to look after them, have to spend more time than they can afford. I think, if the deputy had the appointing of the local officers, better results would follow.

I made it my duty to see if any small fish hatched this season came down the stream into the salt water. I found that the latter part of June thousands of fish, from one to two inches in length, came down the stream and entered the salt water, and I have no doubt most of them will return next season.

With the co-operation of the local officers, I think we can keep our fish and game well protected. I have an extensive knowledge of the characteristics of alewives and smelts, having made a study of their ways and habits in the rivers running into Quincy Bay for a period of over forty years.

Game in this section is not very plenty, for want of sufficient feeding grounds. I have received no complaints from the snaring or killing of game in the close season. I find the Sunday law in regard to fishing and gaming is not well observed. This is especially noticeable at the fishways in the smelting season.

I have had the fish and game laws posted at every fishway, and on many public buildings.

I would like to make a suggestion in regard to fishing for pickerel through the ice in all State ponds. It is a well-known fact that pickerel in our ponds have grown wonderfully less every year, and there should be some protection, if we wish to stop their complete annihilation.

No complaint has been made to me, owing to the lateness in the season of my appointment. If reappointed, I shall visit all the local officers, and make such arrangements as will better protect our fish and game.

Respectfully submitted,

HENRY GARDNER,
Deputy Commissioner.

WORCESTER, Nov. 12, 1896.

MR. E. A. BRACKETT, *Chairman Commissioners of Inland Fisheries and Game.*

DEAR SIR: — Since my last report I have made four arrests: two for fishing with nets, fined \$20; one for fishing with set line, discharged; one for snaring partridges, fined \$20.

Yours very truly,

JOHN F. CUMMING,
Deputy.

SPRINGFIELD, Nov. 18, 1896.

E. A. BRACKETT, Esq.

DEAR SIR: — I desire to report to the commissioners the result in the deer-shooting case, tried at Huntington, November 12. Samuel D. Crouch, the defendant, was fined \$25, which he paid. I desire in this connection to call the attention of the commissioners to the fact that the only law on the statute book for the preservation of deer is that of 1882, which, in the opinion of the court in this section, is very deficient. This man Crouch is now making his boasts that when he can get off for \$25 it's so cheap he will shoot every deer he can find. Up in Blandford, Mass., there is a wealthy farmer who turns a pair of deer loose each year, hoping thereby to increase the number. I suggest some action be taken before the coming Legislature, to change the law.

Respectfully yours,

JAMES ANDERSON.

ARLINGTON HEIGHTS, MASS., October, 1896.

To the Board of Fish and Game Commissioners, E. A. BRACKETT, Chairman.

I would most respectfully report that for the last season ruffed grouse have been quite plenty in this vicinity, woodcock scarce and quail have increased. I knew of but two covies last winter, which I fed all through the heavy snows. This Fall I know of five different broods, and have made arrangements to have grain spread around in different localities, where I think they will pass the winter.

I have not been obliged to make any arrests, although I have stopped several different parties from hunting and fishing on the Lord's Day, and for shooting small birds and game out of season. All were for the first offence.

Respectfully yours,

WM. P. HADLEY,
Deputy.

Extract from Report of Mr. Alexander Jones, Fish Culturist, at Wood's Holl, Mass., Station, on the Lobster Work during the Season.

The lobster work began April 10, with a small collection from the immediate vicinity. The collections were confined for the most of the season to Buzzard's Bay and Vineyard Sound, a territory covering perhaps thirty miles. In some instances collections were also made from New Bedford. The collection of eggs from all sources, up to July, amounted to 80,658,000 eggs, which was the production of 5,580 lobsters. There were 75,189,000 fry produced and liberated in near-by waters. Trips continued to the fishing ground after July 1 and 6,533,000 fry were hatched and planted. These eggs were in an advanced stage of development, and began hatching shortly after being taken, consequently were planted in the locality where they were collected. The total collection of eggs was 90,000,000, which produced 83,722,000 fry,—an increase in eggs over last season of 9,000,000, and in fry of 12,725,000. The greater part of this collection made in July was from New London and Noank, Conn., those caught in these waters having shed their eggs almost entirely by July 1.

GLOUCESTER, MASS., Oct. 28, 1896.

Hon. E. A. BRACKETT, *Chairman Board of Commissioners of Fish and Game.*

DEAR SIR: — About the middle of last April, at the request of the Hon. United States Commissioner of Fish and Fisheries, I received

an appointment as deputy fish and game warden. This appointment also granted authority to "take or cause to be taken egg-bearing lobsters, for the purpose of propagation, at the Gloucester station."

I beg to submit the following report of the work.

The first eggs were taken April 22, and from then until July 13, when the last were received, 708 lobsters, which yielded 9,045,000 eggs, were collected.

During the early part of the season and until as late as the middle of June the field of operations was confined to the territory between Kettle Island and Essex. After that date we attempted to extend our field westward and include all territory to Hull, Mass. Only a very few lobsters were taken in this territory, however, the total being 12 lobsters, which yielded 199,000 eggs.

During the season 8,192,000 fry were hatched and liberated in Massachusetts waters. In planting the fry we endeavored to place them near the fishing centres from which the egg lobsters were received. The field of distribution extends from Marblehead along the coast to Halibut Point and into Ipswich Bay to near Annisquam Light.

The "McDonald universal automatic hatching jar" was the apparatus used in this work, and I think it is the best known at present.

Besides the above, 374 lobsters, which yielded 5,489,000 eggs, were collected in Maine and New Hampshire waters, and the eggs shipped to this station. These eggs produced 4,927,000 fry, 4,271,000 of which were planted in Massachusetts waters.

Respectfully submitted,

E. F. LOCKE,

In Charge of Station.

PROVINCETOWN, 1896.

To the Commissioners on Inland Fisheries and Game.

GENTLEMEN:—I submit the following report as deputy for enforcing the fish and game laws for the year 1896. I have visited the Sandwich, Barnstable and Mashpee woods twice, and found the laws were respected on deer. I received a complaint from Eastham, May 20, of unlawful shooting of shore birds. I visited the marshes three times, and could find no one in that locality. Also received a complaint from Chatham, from the commissioners, to attend to the beach shooting about July 15. I was on the beach four days before July 15, and the law was observed by all the fishermen and sportsmen of Chatham. I have visited fifteen towns and called on all the fishermen, and they were pleased to give me all the information I required. The catch of fish in Barnstable Bay has been large on herring and codfish, other kinds only moderate. Quail are reported very plenty on the Cape. I have put carp in two ponds, one in Truro and one in Wellfleet.

S. B. RICH, *Deputy Commissioner.*

[F.]

LEGISLATION.

Acts of 1896.

[CHAPTER 110.]

AN ACT RELATIVE TO FISHING IN LAKE CHAUBUNAGUNGAMAUG IN THE
TOWN OF WEBSTER.*Be it enacted, etc., as follows:*

Whoever takes or catches any fish in the waters of Lake Chaubunagungamaug, in the town of Webster, between the first day of January and the first day of June in each year, shall be punished by a fine not exceeding twenty dollars for each offence. [*Approved February 25, 1896.*]

[CHAPTER 229.]

AN ACT RELATIVE TO BLACK BASS FISHING.

Be it enacted, etc., as follows:

Whoever takes from the waters of this Commonwealth a black bass less than eight inches in length, or sells or offers to sell or has in his possession with intent to sell any such black bass, shall forfeit ten dollars for each fish so sold or offered or exposed for sale. In any prosecution under this act the possession of any black bass less than eight inches in length shall be prima facie evidence of a violation thereof. [*Approved March 28, 1896.*]

[CHAPTER 259.]

AN ACT TO PROHIBIT FISHING THROUGH THE ICE ON THE NORTHERLY
END OF LAKE QUINSIGAMOND, IN WORCESTER OR SHREWSBURY.*Be it enacted, etc., as follows:*

SECTION 1. Whoever takes or attempts to take through the ice any fish from the water of that part of Quinsigamond lake known as Abbott's pond, in Worcester or in Shrewsbury, northerly of the turn-

pike bridge, at any time prior to the first day of November in the year nineteen hundred and one, shall for each offence be punished by fine not exceeding five dollars; and in any prosecutions under this act the possession of any fish upon, or on the shores of, said lake shall be prima facie evidence of a violation of this act.

SECTION 2. This act shall take effect upon its passage. [*Approved April 11, 1896.*]

[CHAPTER 268.]

AN ACT RELATIVE TO THE TAKING OF SCALLOPS.

Be it enacted, etc., as follows:

SECTION 1. Whoever at any time between the first day of April and the first day of October shall take scallops from any of the flats or waters of the state, or shall buy or sell or have in his possession any scallops, shall be punished by a fine of not less than twenty dollars nor more than fifty dollars for each offence.

SECTION 2. The taking of seed scallops from any of the flats or waters of the state is hereby prohibited, and whoever shall be convicted of taking such scallops shall be punished by a fine of not less than twenty dollars nor more than fifty dollars, but a person taking such scallop and immediately returning it alive to the flat or waters from which it was taken shall not be subject to such penalty.

SECTION 3. Chapter ninety-six of the acts of the year eighteen hundred and eighty-seven is hereby repealed. [*Approved April 13, 1896.*]

[CHAPTER 114.]

RESOLVE TO PROVIDE FOR THE ESTABLISHMENT OF A FISH HATCHERY
IN THE WESTERN PART OF THE COMMONWEALTH.

Resolved, That there be allowed and paid out of the treasury of the Commonwealth a sum not exceeding three thousand dollars, to be expended under the direction of the commissioners on inland fisheries and game for the purpose of establishing and maintaining in the western part of the Commonwealth a hatching house for the propagation of trout, salmon and shad, and for the purchase and erection of buildings necessary for that purpose. [*Approved June 4, 1896.*]

[G.]

LOBSTER RETURNS.

1896.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
Joseph Rogers, . Manuel Silvia, . Joseph Gasper, . J. M. Pinta, . J. P. Serrilha, . Joseph Silva, . Peter Silvia, . Albert Hansen, . Tony Silva, . A. F. Ferreira, . Joaquin Perry, . Antoine Silvia, . Manuel P. Silvia, . M. E. Grace, . A. P. Silvia, . A. P. Silva, . Antonio Francis, . J. R. Ferreira, . Andrew Ferreira, . Tom Winslow, . Custodio Goveia, . Antone A. Silva, . M. De Rosa Dias, . M. D. Moura, . J. E. Alberto, .	Boston, . .	2,964	118,996	1,942
J. E. Cahoon, . .	Barnstable, . .	40	1,211	-
C. B. Chapman, . W. E. Bennett, . W. H. Kennedy, . C. D. Davis, . C. C. Foster, .	Beverly, . .	248	16,339	373

Lobster Returns — Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
J. E. White, . . . A. L. Manter, . . . H. C. Phillips, . . . D. B. Blackman, . . . H. P. Taylor, . . . N. C. Besse, . . .	Brant Rock, .	378	11,923	168
Henry Beal, . . . Thomas Mason, . . . John Monroe, . . . W. E. Merryman, . . .	Beachmont, .	295	5,273	136
A. B. Robinson, . . .	Bay View, . .	75	6,100	98
T. C. Leonard, . . .	Bournedale, .	50	2,782	86
W. H. Phinney, . . . H. L. Sampson, . . . H. A. Jordan, . . . Charles Rogers, . . . C. H. Pierce, . . . R. F. Swift, . . . J. W. Sampson, . . . L. S. Thurston, . . . George Atwell, . . . George Boutin, . . . Charles Boutin, . . . David Pierce, . . .	Chiltonville, .	523	27,889	565
Franklin Tilton, . . . F. N. Smith, . . . R. P. Reed, . . . L. E. Atheron, . . . L. E. Cottle, . . . Onslow Stewart, . . .	Chilmark, . .	127	2,855	150
S. Patterson, . . . R. T. Bearse, . . . W. F. Hitchings, . . . Arthur Baker, . . . C. W. Jones, . . . E. S. Gould, . . . H. S. Doane, . . . E. Z. Ryder, . . . Fred Baker, . . . F. B. Nickerson, . . . D. C. Harding, . . . Robert Ellis, . . . Sylvester Eldridge, . . .	Chatham, . .	2,093 . . .	48,735 . . .	1,518

Lobster Returns — Continued.

PROPRIETOR. .	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
J. F. Eldridge, . W. R. Bloomer, . W. A. Bloomer, . O. M. Gould, . G. N. Eldridge, . Thomas Holway, . A. H. Bearse, . Geo. F. Rogers, . G. W. Bloomer, . F. Bloomer, . H. F. Gould, . Richard Gould, . A. S. Hammond, . F. W. Nickerson, Jr., C. F. Eldridge, . O. C. Eldridge, . B. N. Bloomer, . B. Bassett, .	Chatham, . .	2,093	48,738	1,518
Manuel Vandura, . A. S. Figneredo, . J. F. Bandura, . M. S. Almas, . M. S. Thomas, . J. A. Silvia, . J. J. Grassie, . Levi Cadoza, . Oscar Anderson, . M. P. Valine, . Robert Ainslies, . F. E. Salvador, . Geo. E. Antoine Andrew Peterson, J. M. Smith, .	Cohasset, . .	1,379	70,641	1,023
A. Tilton & Co., . J. E. Johnson, . H. J. Allen, . John Manley, . R. W. Rotch, . O. H. Stetson, . C. C. Allen, . Joshua Keeney, . Alfred Beebe, . Frank Peters, . J. H. Tilton, . J. W. Tilton, . D. P. Bosworth, . H. J. Jamieson, .	Cuttyhunk, . .	669	50,210	2,443

Lobster Returns—Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
J. F. Cornell, . . . F. M. Cottle, . . . Levi Jackson, . . . Robert Jackson, . . .	Cuttyhunk, . . .	669	50,210	2,443
J. E. Ellis, . . . Geo. E. Hall, . . . M. L. Howes, . . .	Dennis, . . .	36	494	102
W. A. Gifford, . . . Geo. N. Briggs, . . . Antoine De Avello, . . . J. H. Butts, . . . C. F. Manchester, . . .	Dartmouth, . . .	200	4,463	783
Geo. F. Freeman, . . . J. K. Burgess, . . . O C. Hunt, . . . Isaac Symmes, . . . C. E. Peterson, . . . E. W. Cook, . . . F. E. Philipps, . . . Clarence Smith, . . . W. E. Peterson, . . . F. E. Wadsworth, . . .	South Duxbury, . . .	379	25,801	195
H. O. Hillman, . . . Antoine Silvia, . . . John Bunker, . . .	Edgartown, . . .	96	4,164	324
Fernando Josef, . . . Lemuel Davis, . . . E. E. Baker, . . . A T. Chadwick, . . . W. A. Grew, . . . C. N. Jennings, . . . W. E. Nickerson, . . .	Falmouth, . . .	86	2,837	159
H. N. Wilbur, . . .	Fairhaven, . . .	23	201	28
J. H. Tripp, . . .	Fall River, . . .	62	1,720	85
C. H. Ryan, . . .	Gay Head, . . .	25	1,219	135
Joseph Douglass, . . . E. L. Small, . . . Walter Marchant, . . . E. D. Rust, . . . D. N. Mehlman, . . .	Gloucester, . . .	611	45,686	703

Lobster Returns — Continued.

PROPRIETOR.	TOWN.	Number of Traps used	Number of Large Lobsters taken.	Number of Eggs- bearing Lobsters liberated.
H. W. Nelson,	Gloucester,	611	45,686	703
E. F. Parsons,				
Melvin Parsons,				
F. S. Alba,				
Albert Parsons,				
Charles Nason,				
Joseph Parsons,				
Geo. Sargent,				
Fred Parsons,				
Wilfred Keene,	Green Harbor,	688	31,490	294
W. H. Tolman,				
W. M. Cushing,				
Elbridge Perkins,				
George Delano,				
C. R. Peterson,				
Lyman Sears,				
H. P. Tolman,				
O. A. Chandler,				
B. P. Williamson,				
E. R. Lapham,				
C. B. Cushing,				
Thomas Pezzy,				
F. N. Bencordo,	Hyannis,	235	3,677	343
Geo. Sampson,				
T. F. Phinney,	Hull,	728	37,536	488
O. S. Crosby,				
A. B. Mitchell,				
Andrew Galliano,				
M. McDonald,				
A. Cleverley,				
J. D. Reed,				
B. F. Pope,				
F. Smith,				
E. F. Pope,	Ipswich,	70	3,325	92
G. L. Hatch,				
A. B. Cleverley,				
Rust & Grant,				
Charles A. Bailey,	Lanesville,	173	8,435	219
Henry L. Look,				
W. B. Atkinson,				
Warren Poland,				
G. H. Woodbury,				
A. W. Riley,				
Elias Haraden,				

Lobster Returns—Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
W. H. Sargent, . Addison Woodbury, . Herman Marchant, .	Lanesville, .	173	8,435	219
J. J. Nye, . W. L. Richmond, . Lilburne Hiller, .	Mattapoisett, .	56	1,141	108
C. G. Story, . David Worth, . H. K. Story, . J. B. Knowlton, . J. G. Burnham, . W. S. Douglass, .	Magnolia, .	249	9,934	603
Sans Stanley, . J. W. Smithers, . Frank Dixey, . J. H. Magee, . J. T. Adams, . C. H. Smithurst, . J. W. Florence, . R. T. Millett, . W. F. Allen, . W. H. Tutt, . J. G. Stacy, . Geo. Hooper, . R. F. Russell, . Wm. J. Dodd, . J. W. Mace, . C. O. Briggs, . John Brown, . J. E. Stone, . Wm. W. Russell, . B. F. Stevens, . S. B. Perkins, . S. Q. Smith, . J. H. Hennessey, . B. H. Swett, . R. G. H. Roundy, . Richard Farry, .	Marblehead, .	933	71,728	2,750
Thomas Dow, . J. H. Dow, . L. O. Sargent, . J. S. West, . Charles Sargent, . J. H. Heath, .	Manchester, .	146	6,110	106

Lobster Returns — Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
C. H. Gurney, . . . Roswell Briggs, . . .	Marion, . . .	62	2,530	116
Geo. Griswold, . . . Samuel Bartlett, . . . J. H. Valler, . . . Robert Richards, . . . Cornelius Briggs, Jr., . . . L. B. Briggs, . . . Wm. Harlow, . . . Charles Wakefield, . . . Geo. A. Manter, . . . H. C. Bennison, . . . W. H. Peterson, . . . C. H. Dixon, . . . Charles L. Griswold, . . . James Gould, . . . F. R. Peterson, . . . Henry Dodge, . . . P. M. Grath, . . . S. B. Blackmer, . . . A. L. Holmes, . . . Stephen Holmes, . . . C. W. Holmes, Jr., . . . E. H. Arnold, . . . G. W. Holmes, . . . M. L. Chandler, . . . Thomas Jordan, . . . A. A. Nightingale, . . . W. J. Nightingale, . . . Thomas Stephens, . . .				
Charles Wilson, . . . S. M. Babbett, . . . John Johnson, . . . C. H. Place, . . . B. A. Atwood, . . . C. H. Bates, . . .	Nantasket, . . .	282	12,905	134
Manuel Gracia, . . . A. G. Mayhew, . . . Manuel Flores, . . . A. F. Fratus, . . . M. F. George, Jr., . . . Ventrene Perry, . . . Manuel Simmons, . . . Joseph Fratus, . . . G. B. Taber, . . . John Sater, . . . C. P. Matterson, . . .				
	New Bedford, . . .	1,174	44,364	3,609

Lobster Returns — Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
Joseph Silva, . . . Frank Duthie, . . . Joseph Marshall, . . . Manuel Madevi, . . . John Louise, . . . Antoine Vera, . . . Manuel Marshall, . . . Alonzo Holmes, . . . W. E. Skiff, . . . John Cross, . . . Joseph Marshall, . . . M. F. Elias, . . . Joseph Souza, . . .	New Bedford, . . .	1,174	44,864	3,609
C. W. Taylor, . . . G. H. Lamphin, . . . Samuel Covell, . . . G. W. Taylor, . . . C. E. Gove, . . .	Nahant, . . .	154	11,048	99
J. R. West, . . . M. W. Dunham & Co., . . . Geo. H. Dunham, . . . J. H. Eldridge, . . . Wm. Norcross, . . . W. N. Chase, . . . Jesse Seel, . . . A. B. Brooks, . . . J. H. Dennis, . . . A. A. Norcross, . . . J. N. Small, . . . J. P. Sansbury, . . . O. R. Pease, . . . John Watkins, . . . James A. Backus, . . . G. E. Coffin, . . .	Nantucket, . . .	562	23,214	752
F. H. Hayden, . . . Caleb Hayden, . . .	Orleans, . . .	33	783	27
David Newcomb, . . . Wm. H. Kenny, . . . Geo. Freeman, . . . F. M. Bowley, . . . J. W. Savage, . . . W. C. Snow, . . . J. C. Lenten, . . . J. D. Smith, . . . A. J. Emery, . . . J. H. Little, . . .	Provincetown, . . .	381	8,558	760

Lobster Returns — Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
Amos Lufkin, . . . Fred Johnson, . . . C. N. Morgan, . . .	Pigeon Cove, .	97	4,832	8
A. M. Watson, Jr., . . . James Deacon, . . . L. G. Doten, . . . J. M. Watson, . . . Jerome Stone, . . . A. C. Sampson, . . . W. R. Thomas, . . . J. P. Thurston, . . . S. P. Burgess, . . . J. H. Bagnell, . . . J. B. Walker, . . . Oscar Marsh, . . .				
C. P. Peterson, . . .	Quincy, . . .	45	2,846	1
Geo. E. Wendell, . . . Peter Dixon, . . . Wm. Stillman, . . .	Rockport, . . .	185	12,273	374
Chas. H. Parker, . . . E. W. Haines, . . . G. L. Haines, . . . C. E. Hoxie, . . . J. D. Smith, . . .				
Chas. S. Brown, . . . H. G. Tucker, . . . James Fagan, . . . W. D. Huntress, . . . C. H. Berry, Jr., . . . G. W. Berry, . . . John Clarke, . . .	Salem, . . .	456	11,505	363
A. H. Gibbs, . . . Ezra Pierce, . . .	Sagamore, . . .	45	1,279	70
Everett Litchfield, . . . E. P. Pratt, . . . Francis Mulkerne, . . . J. K. Gannett, . . . Eugene Pratt, . . . Wm. Ward, . . . Geo. F. Edson, . . . J. W. Spooner, . . . Daniel Ward, . . . John Barry, . . .	Scituate, . . .	1,094	42,486	949

Lobster Returns—Continued.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
Thomas Flynn, . Thomas Dwyer, . C. Driscoll, . Oscar Palmgreen, . John Welsh, . John Murphy, . John Raymond, . Edmund Landers, . James Dwyer, . D. W. Ward, .	Scituate, . .	1,094	42,486	949
C. L. Cleveland, . J. D. Tillton, . A. T. Poole, . L. W. Mayhew, . A. E. Reed, .	Squibnocket, .	108	2,926	151
W. J. Jones, . G. A. R. Horton, . A. G. Watts, . L. F. Woodbury, . T. E. Stone, . Henry Bayer, . Edward Marsh, Jr., . R. A. Douglass, .	Swampscott, .	875	39,696	256
C. H. Lord, . .	Salisbury, . .	7	242	3
G. H. Luce, . J. R. Tillton, . G. A. Rogers, . G. F. Tillton, . G. W. Manter, .	Tisbury, . .	140	2,342	89
Warren Freeman, . C. H. Collins, . J. C. Myricks, .	Truro, . .	80	884	94
M. F. Cleveland, . Geo. E. Dolby, . F. M. Chase, . O. D. Bradley, . J. R. Cleveland, . C. B. Cleveland, . Fred Weeks, . F. C. Vincent, . Herbert Crocker, . A. B. Lewis, . Chas. B. Cleveland, .	Vineyard Haven, .	292	11,923	843

Lobster Returns — Concluded.

PROPRIETOR.	TOWN.	Number of Traps used.	Number of Large Lobsters taken.	Number of Egg- bearing Lobsters liberated.
G. A. Gifford, . . . Chas. W. Hammond, . T. J. Brightman, . . .	Westport, . . .	79	2,697	350
John Wadsworth, . . . J. B. Wyman, . . .	Winthrop, . . .	94	8,761	161
M. L. Lawson, . . . J. K. P. Purdum, . . . F. R. Gifford, . . . P. W. Wainswright, . Lewis Phillips, . . . J. J. Veeder, . . . P. M. Stewart, . . . Alfred Nickerson, . . Thomas Hinckley, . . Frank Peterson, . . . O. C. Grinnell, . . . E. F. Donnelly, . . . H. A. Hilton, . . . H. P. Phinney, . . . Clarence Ramsdell, . L. L. Adams, . . . N. C. Phinney, . . . A. E. Bragg, . . . J. F. Cook, . . .	Wood's Holl, . . .	376	22,515	2,953
Herbert Lovell, . . .	Yarmouth, . . .	26	851	76
Totals (men, 453), . . .	. . . . .	22,041	995,396	30,470

Comparisons of Returns of Lobster Fisheries.

YEAR.	Number of Men.	Number of Traps.	Number of Large Lobsters taken.	Number of Egg-bearing Lobsters liberated.
Increase of 1894 over 1893, . .	54	8,291	—	2,156
Decrease of 1894 below 1893, . .	—	—	52,898	—
Increase of 1895 over 1894, . .	—	—	—	—
Decrease of 1895 below 1894, . .	48	3,098	140,469	554
Increase of 1896 over 1895, . .	76	4,836	39,031	—
Decrease of 1896 below 1895, . .	—	—	—	3,873

GILL AND SWEEP NETS—1896.

GILL AND SWEEP NETS.

1896.

PROPRIETOR.	TOWN.	Salmon.	Shad.	Alewives.	Sea Herring.	Menhaden.
F. G. Kelley,	Barnstable,	-	-	109,600	-	-
Alexander Sargent,	Bay View,	1	-	-	199,625	-
Thomas James,	Berkley,	-	215	110,000	-	-
J. N. Babbett,	Brewster,	-	-	180,857	11,200	-
J. N. Winslow,	Centreville,	-	-	-	-	-
Niles Nelson,	Chiltonville,	-	-	40,720	-	-
W. O. Kelley,	Chilmark,	-	-	-	-	-
C. E. Bearse,	Cohasset,	-	38	-	30	-
A. S. Hadaway,						
W. S. Mayhew & Bros.,						
Robert Ainsley,						
Geo. W. Crowell,						
A. W. Smith,						
Geo. W. Bloomer,						
E. B. Ryder,						
E. S. Gould,						
W. H. Patterson,						
W. F. Hitchings,						
J. F. Eldridge,						
R. F. Nickerson,						
O. D. Hammond,						
C. F. Eldridge,						
R. T. Bearse,	Chatham,	-	-	168	-	7
J. S. Ryder,						
C. C. Nickerson,						
W. A. Bloomer,						
Geo. W. Eldridge,						
H. F. Gould,						
J. D. Bloomer,						
A. S. Hammond,						
Wm. H. Gould,						
Seymour Patterson,						
O. C. Eldridge,						
G. W. Gould,						
E. D. Perry,						
I. A. Hardy,	Dighton,	-	1,872	792,149	-	-
C. N. Simmons,	South Duxbury,	-	-	-	-	-
Isaac Symmes,						
A. P. Howes & Co.,						
Geo. E. Hall,						
G. G. Snow,	Dennis,	-	-	-	-	-
F. H. Mayo,						
Nehemiah Edwards,						
J. H. Long,						
W. S. Osborne,	Edgartown,	-	-	241,704	-	-
J. H. Jones,	Falmouth,	-	-	28,150	-	-
Joseph Douglass,						
Thomas Douglass,						
Alfonzo Tarr,	Gloucester,	1	99	2,400	640,220	55,575
B. F. Bowden,						
B. F. Saunders,						
Wm. P. Goodwin,	East Haverhill,	-	7	64	-	-
Edwin Taylor,	Hyannis,	-	-	-	-	-
T. F. Phinney,						
W. A. Nickerson,	Harwich,	-	-	-	2,715	-
B. W. Dove,						
A. W. Riley,						
J. W. Marchant,	Lanesville,	-	-	-	396,059	-
J. J. Woodbury,						
Rufus L. Savery,	Marion,	-	-	169,197	-	-
Jones Bros.,	Manchester,	-	-	-	22,750	-
Chandler Lewis,						
R. T. Millett,						
Chas. E. Rogers,						
R. C. Glass,	Marblehead,	1	-	-	22,500	-
S. B. Perkins,						
B. F. Stevens,						

GILL AND SWEEP NETS.

1896.

Striped Bass.	Scup.	Squeteague.	Sea-bass.	Butter-fish.	Bonito.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Squid.	Other Edible or Salt Fish.
-	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	13,799	-	-	20	1,885	20,320	16,000
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	47,100	-	350	240	-	-	-
195	-	11	-	-	45	-	21	2,278	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	284
-	-	164	-	-	-	-	-	294	-	-	-	-
-	-	-	-	2	-	95	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
135	-	159	-	31	417	10,803	-	2,461	-	-	-	5,257
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	4,845	-	-	-	-	-	-
44	-	27	-	-	5	15,433	-	1,878	-	-	-	3,613
120	-	-	-	-	-	-	-	-	-	-	-	5,150
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	13,703	-	-	-	-	1,276	27,514
1	-	-	-	-	-	-	-	-	-	-	-	-
-	-	21	-	-	-	207	-	186	11	-	-	-
-	-	-	-	-	-	1,303	-	-	-	27	-	-
-	-	-	-	-	-	4,102	-	-	-	-	1,368	3,626
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	1,253	-	-	-	-	-	1,000
-	-	-	-	1,439	-	6,273	-	-	-	183	-	-

Gill and Sweep Nets — Continued.

PROPRIETOR.	TOWN.	Salmon.	Shad.	Alewives.	Sea Herring.	Menhaden.
O. L. Prescott,	Middleboro,	-	-	83,401	-	-
H. E. Dunham,						
M. W. Dunham & Co.,						
A. F. Meiggs,						
Manuel Thomas,						
Leander Small,						
J. R. Silvia,						
E. W. Ramsdell,						
J. H. Eldridge,						
W. I. Fisher,						
C. S. Glidden,						
G. H. Hamblin,	Nantucket,	-	-	114	-	25
H. O. Orpin,						
John Watkins,						
M. I. Francis,						
G. M. Winslow,						
G. E. Thomas,						
A. C. Manter,						
A. H. Adams,						
C. B. Cathcart,						
G. H. Spencer,						
A. H. Small,						
N. L. Thurlow,						
G. G. Short,						
Joseph Thurlow,	Newburyport,	-	-	674,600	4,058,031	92,250
O. A. Caswell & Co.,						
F. O. Hunt,						
Richard Pierce,						
Antoine Gracia,	New Bedford,	-	-	-	-	-
R. W. Cook,						
W. M. Elwell,						
G. H. Hurlburt, Jr.,						
Needham Rogers,						
E. H. Tillson,						
J. O. Lurten,						
Manuel Williams,						
O. H. Emery,						
W. M. Wareham,						
Daniel Williams,						
J. S. Harvender,						
Jonathan Sparrow,						
H. N. Smith,						
R. G. Tarrant,						
Seth Nickerson,						
William Dyer,						
D. L. Smith,						
A. J. Emery,						
A. L. Daggett,						
S. L. Ellis,						
B. R. Kelley,						
J. H. Little,	Provincetown,	-	10,625	223,731	1,981,523	25,146
N. W. Newcomb,						
Joseph Ellis,						
J. S. Smith,						
G. A. Brown,						
George Crosby,						
Jonah Newcomb,						
A. A. Mayo,						
George Lewis,						
S. F. Atwood,						
Samuel Small,						
Boniface Silvey,						
W. C. Snow,						
Frank Days,						
F. N. Days,						
J. D. Smith,						
Reuben Ryder,						
H. L. Mayo,						
Manuel Tarvis, Jr.,						
J. F. Atkins,						
Geo. H. Lewis,						
J. A. Cobb,						

Gill and Sweep Nels — Continued.

Striped Bass.	Scup.	Squeteague.	Sea-bass.	Butter-fish.	Bonito.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Squid.	Other Edible or Salt Fish.
-	-	-	-	-	-	-	-	-	-	-	-	-
83	242	715	29	24	2,238	6,083	-	48,159	4	-	71	1,839
-	-	-	-	-	-	-	-	-	-	-	-	119,130
-	-	-	-	-	-	-	-	-	8,928	-	-	-
6	-	-	-	749	-	448,200	-	13,858	550	204,983	11,197	11,166

Gill and Sweep Nets — Concluded.

PROPRIETOR.	TOWN.	Salmon.	Shad.	Alewives.	Sea Herring.	Menhaden.
M. S. Brown,	Provincetown, .	-	10,625	223,731	1,981,523	25,146
J. R. Swartz,						
James Bangs,						
E. W. Smith, Jr.,						
Zephaniah Rich,						
E. Q. Weeks,						
Isaac Tyler,						
R. O. Kelley,						
Henry Atwood,						
Joseph Wolf,						
John Atkins,						
F. N. Atwood,						
Wm. Newcomb,						
J. H. Emery,						
G. N. Freeman,						
J. W. Savage,						
J. H. Fuller,						
J. P. Williams,						
Joseph Patrick,						
Prince Freeman,						
Jesse Ghen,						
Manuel Carter,						
J. E. Weeks,						
L. P. Hatch,						
John Dolan,						
Thomas Lopes,	Plymouth, . . .	-	-	-	-	-
E. A. Wheldin,						
Bangs & Lewis,	Raynham, . . .	-	1,682	487,917	-	-
Martin Silva,						
G. N. Maker,	Rockport, . . .	-	-	-	56,812	-
William Harlow,						
Cornelius Briggs, Jr.,	Scituate, . . .	-	-	109	9,909	-
Gustavus King,						
G. B. & E. Williams,	Somerset, . . .	-	-	403	-	-
H. P. Macomber,						
Gilbert Rich,	Sandwich, . . .	-	-	-	-	-
O. W. Gott,						
Geo. T. Edson,	Truro,	-	-	-	4,800	-
Robert O'Hearne,						
J. K. Gannett,	Westport, . . .	-	-	27,851	-	-
William Ward,						
James Edson,	Wellfleet, . . .	-	-	186,500	6,000	-
G. W. Simmons,						
T. W. Luther,	Yarmouth, . . .	-	-	-	-	-
J. D. Smith,						
E. W. Haines,	Totals (208 men),	3	14,538	3,359,635	7,407,174	173,003
J. Atwood,						
T. D. Smith,						
W. W. Freeman,						
E. D. Doyle,						
C. H. Collins,						
J. T. Stevens,						
Joseph Morris,						
J. C. Myricks,						
M. V. Silva,						
F. D. Grinnell,						
W. M. Soule,						
A. G. Allen,						
I. E. Snell,						
E. P. Cook,						
J. E. Curran,						
W. P. Doane,						
H. F. Atwood,						
Manuel G. Gio,						
Theo Brown,						
Herbert Lovell,						
Roland Kelly,						

Gill and Sweep Nets — Concluded.

Striped Bass.	Scup.	Squeteague.	Sea-bass.	Butter-fish.	Bonito.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Squid.	Other Edible or Bait Fish.
6	-	-	-	749	-	448,200	-	18,858	550	204,983	11,197	11,166
-	-	-	-	4	-	243	-	-	-	-	13	217
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	1,180	-	-	-	-	-	2,800
-	44	-	-	5	-	1,776	-	-	-	-	85	2,220
22	-	-	-	237	-	-	-	-	158	-	-	250,375
-	-	-	-	-	-	1,812	-	-	-	-	-	-
-	-	-	-	30	-	3,516	-	25	-	-	2,094	340
-	-	-	-	-	-	-	-	-	-	-	-	6,477
-	632	-	-	-	-	12,627	-	-	971	-	-	4,365
6	-	-	-	-	-	7,495	-	-	-	-	-	-
615	918	1,087	29	2,521	2,695	601,298	21	68,989	10,882	207,078	36,424	460,873

1896.

PROPRIETOR.	TOWN.	Salmon.	Shad.	Alewives.	Sea Herring.	Menhaden.	Striped Bass.
T. L. Mayo, : : { W. W. Hallett, : : }	Barnstable, .	40	143	1,343	-	450	8
E. P. Gibbs, . . .	Bourne, . .	-	155	-	57,750	-	1
T. Ellis & Son, . . . } J. Eldridge & Son, : : } F. D. Atwood, : : } Fred Young, . . . }	Brewster, .	-	1,432	110,158	79,570	232	130
W. F. Flanders, . . . } Daniel Vincent, . . . } J. Look & Co., . . . } F. P. Tilton, . . . } D. W. West, . . . } G. W. Manter, . . . }	Chilmark, .	31	358	18,877	5,612	4,872	49
Reed Loveland & Co., : : } N. B. Nickerson, . . . } B. L. Jones, . . . } S. W. Gould, . . . }	Chatham, .	-	1,909	83,331	185,950	7,391	14
Ellert Wefer, . . . } Z. H. Baker, . . . } William Crowell, . . . } A. T. Chase, . . . } Thatcher Kelly, . . . }	Dennis, . .	-	646	178,406	141,436	10,569	6
E. D. Howland, . . . } Waite & Smith, . . . } George Priaulx, . . . } Nicholas Priaulx, . . . } William T. Dunn, . . . } Antone Anderson, . . . } G. A. Snell & Co., . . . } Snell & Butts, . . . } J. A. Manchester, . . . } Tallman & Gifford, . . . } E. H. Smith, . . . } H. P. Dunn, . . . } W. S. Matthews, . . . } J. F. Crapo, . . . } B. T. Smith & Co., . . . }	Dartmouth, .	-	522	363,888	6,580	226,279	458
F. W. Smith, . . . } W. H. Nickerson, . . . } A. K. Higgins, . . . }	Eastham, . .	-	5	16,794	150,075	-	6
C. B. Coombs, . . . } John Manley, . . . } A. B. Veeder & Co., . . . } H. J. Allen, . . . } Wm. Shephard, . . . } Church & Keeney, . . . } P. B. Davis, . . . } H. W. Daggett, . . . } Isalah Spindell, . . . }	Gosnold, . .	-	402	181,310	-	1,273	68
B. Luce & Co., . . . } L. L. Vanderhoop, . . . } W. L. Pease & Co., . . . }	Gay Head, .	-	18	22	1,600	92	1

POUNDS AND WEIRS.
1896.

Soup.	Squeteague.	King fish.	Sea-bass.	Butter-fish.	Bonito.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Squid.	Other Edible or Bait Fish.
4,372	62	25	-	1,037	23	109,702	-	3,915	129	651	23,200	-
128	5	-	2	4,308	-	89,399	-	-	680	38	88,400	5,309
25	59	-	1	2,394	5	103,136	-	209	1,207	7,933	4,675	10,223
240,231	38,905	36	1,228	29,752	2,370	87,662	3	123	278	5,916	269,400	22,407
276,713	76	62	341	16,869	8	15,719	-	23	173	4,623	227,339	277,609
113,449	525	117	-	699	344	168,668	7	180	731	4,553	210,582	1,155
563,555	99,987	169	113	399,742	81	73,317	21	688	19,402	63,502	247,272	45,342
-	298	-	-	29	-	5,432	-	3,379	2,351	747	14,160	-
1,785,375	51,596	5	30,992	310,217	724	22,569	2	204	3,471	32,584	85,193	462,012
246,100	43,660	4	1,751	3,355	194	36,331	-	5	18	3,341	10,775	-

Pounds and Weirs — Concluded.

PROPRIETOR.	TOWN.	Salmon.	Shad.	Alewives.	Sea Herring.	Menhaden.	Striped Bass.
B. H. Hodgkins, . . .	Gloucester, .	2	886	9,900	249,310	31,240	-
A. E. Douglass, . . .							
G. M. Douglass, . . .							
H. W. Nelson, . . .							
C. E. Nason, . . .							
F. T. Lane, . . .							
D. F. Weeks & Co., . .	Harwich, .	-	103	6,062	14,200	2,002	96
E. E. Robbins, . . .							
N. B. Smith, . . .							
F. A. Tarr, . . .	Magnolia, .	-	-	-	209,900	-	-
E. W. Heath, . . .	Manchester, .	-	40	92,927	936,412	242	-
William Elwell, . . .							
T. L. Mayo, . . .	Nahant, .	-	764	4,640	342,860	2,780	-
R. E. Cornwell, . . .	Provincetown,	-	92	56,534	2,665,142	1,398	15
T. K. Paine, . . .							
H. J. Lewis, . . .							
J. A. Lewis, . . .							
Perez Bangs, . . .							
I. B. Lewis, . . .							
I. W. Lewis, . . .							
B. B. Baker, . . .	Plymouth, .	-	-	-	-	-	-
A. L. Smith, . . .	Revere, .	-	10	-	403,000	500	-
Isalah Spindell, . . .	Sagamore, .	-	44	-	7,400	500	-
G. A. Phinney, . . .							
Robert Perry, . . .	Sandwich, .	-	70	-	3,200	-	-
Isalah Spindell & Co.,							
C. B. Jones, . . .	Swampscott, .	-	-	-	223,850	-	-
G. W. Manter, . . .	Tisbury, .	-	820	21,535	12,232	3,099	240
H. B. Davis & Co., . .							
Jason Luce & Co., . . .							
O. S. Daggett, . . .							
D. D. Look, . . .							
H. N. Luce, . . .							
Edward Cottle, . . .							
P. L. Paine, . . .	Truro, .	1	2,659	61,967	5,262,879	254,112	5
D. B. Rich, . . .							
W. F. Baker, . . .							
Atkins, Hughes & Co.,							
D. Blatchford, . . .							
S. B. Atwood, . . .							
N. B. Rich, . . .							
N. O. Atwood, . . .							
R. A. Rich, . . .							
J. O. Norton, . . .	Vineyard Haven,	-	32	26,676	5,800	12,140	12
J. R. Walker, . . .							
W. D. Cleveland, . . .							
N. B. Rich, . . .	Wellfleet, .	-	-	-	99,400	2,000	-
P. M. Stewart, . . .	Wood's Holl, .	-	6	585	23	2,070	-
S. L. Robbins, . . .	Yarmouth, .	-	-	34,520	-	-	-
Totals (101 men),	74	10,616	1,269,475	11,063,681	563,241	1,098

Pounds and Weirs — Concluded.

Scup.	Squeteague.	King-fish.	Sea-bass.	Butter-fish.	Bonito.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Squid.	Other Edible or Salt Fish.
-	-	-	-	3,945	-	7,967	-	1	2	342	11,850	304,502
4,983	3,268	7	3	15,701	403	2,986	5	415	832	1,303	173,500	2,741
-	-	-	-	-	-	5,041	-	-	-	-	12,200	-
91	-	-	-	98	-	9,816	-	-	52	863	5,520	4,100
70	1,000	-	5	272	-	3,010	-	-	68	783	4,450	-
101	160	-	80	1,476	2	54,091	2	5	33	19,075	782,770	1,360,251
-	-	-	-	1	-	14,946	-	-	40	24	-	-
-	-	-	-	30	-	6,492	-	-	-	-	4,500	20
54	28	-	-	3	-	10,105	-	18	1,168	-	652,800	-
-	-	-	-	-	-	11,729	-	-	111	-	155,450	-
-	-	-	-	305	-	4,210	-	-	-	-	-	7,750
147,725	23,985	252	768	10,895	4,260	43,578	1	655	645	4,308	93,250	1,243
144	3,285	29	-	15,314	7	848,675	35	72	386	40,617	699,224	517,375
262,571	1,091	1	212	12,783	1,854	25,966	1	79	235	2,506	20,550	117,005
-	-	-	-	3,637	-	7,440	-	-	-	742	2,200	4,000
17,457	1,355	9	44	1,638	45	2,109	-	24	56	305	861	102
-	-	-	-	-	-	-	-	-	1	46	-	-
3,663,149	269,345	716	35,530	834,000	10,315	1,770,146	77	9,995	31,569	194,804	3,800,121	3,152,145

Comparison of Returns for the Years 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895 and 1896.

Year	Fisheries.		Bld.	Alewives.	Gas Herring.	Menhaden.	Striped Bass.	Coop.	Bqueleagues.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Bquid.	Other Edible or Bait Fish.
	Kind.	No.														
1882,	Pounds and weirs,	85	27,769	1,420,919	1,201,449	8,102	4,219	1,991,480	67,266	8,289,512	310	133,806	40,512	114,843	4,016	-
1883,	"	87	5,994	1,250,263	339,116	4,048,022	2,876	1,848,583	92,671	4,756,490	246	60,182	35,481	184,387	5,361	-
1884,	"	93	5,392	715,886	2,806,203	308,381	6,950	1,641,129	74,826	1,440,486	99	109,694	23,929	288,930	33,980	-
1885,	"	80	18,068	1,066,148	6,564,619	6,255	1,365	1,240,630	17,746	2,643,190	24	32,575	47,231	317,082	7,741	128,698
1886,	"	58	15,874	1,012,802	1,364,684	48,910	2,412	1,966,243	3,226	1,290,466	20	17,315	47,490	261,596	11,570	672,334
1887,	"	62	14,044	1,453,820	1,713,846	127,961	1,233	2,153,504	15,742	1,069,609	109	44,204	89,075	304,492	7,615	812,810
1888,	"	83	50,057	1,064,607	6,665,698	1,202,777	2,455	1,448,451	127,602	2,877,768	115	38,376	63,214	358,917	10,806	2,716,892
1889,	"	103	25,591	1,417,950	17,000,308	1,203,669	4,924	1,331,673	36,043	825,152	524	17,287	69,719	289,993	20,163	1,859,924
1890,	"	88	22,961	1,198,561	4,432,690	2,911,970	5,302	354,423	43,988	1,297,264	1,242	60,633	25,637	210,476	9,180	958,872
1891,	"	87	26,587	2,039,107	10,643,504	1,976,856	1,413	3,160,446	98,749	3,045,814	823	28,355	33,476	389,416	17,511	569,794
1892,	"	83	14,658	1,031,160	15,739,505	124,917	1,410	2,421,985	70,085	4,706,233	47	16,296	45,881	346,772	8,069	1,588,890
1893,	"	99	13,440	816,841	16,895,378	1,615,025	561	2,216,406	304,896	2,283,635	2,011	15,842	34,894	284,122	2,643,123	1,419,042
1894,	"	105	6,754	1,378,703	15,361,317	1,162,174	1,849	394,224	300,875	4,127,338	269	14,799	28,715	195,643	2,086,309	1,242,595
1895,	"	102	14,823	1,000,968	22,182,517	1,052,983	2,465	1,464,697	145,331	786,987	58	26,024	435,267	356,933	3,006,544	4,209,153
1896,	"	101	10,616	1,269,475	11,063,681	563,241	1,098	3,663,149	269,345	1,770,146	77	9,995	31,569	194,804	3,800,121	4,032,706
1888,	Traps, fykes and irregular returns,	8	-	5,150	252,685	7,750	-	-	-	288,466	-	-	-	8,123	3,544	-
1889,	Traps, fykes and irregular returns,	15	2,994	89,516	1,212,942	184,239	64	86	54	64,938	1	2,690	339	2,246	2,080	76,073
1882,	Gill nets and sea seines,	133	1,738	424,630	310,611	633	1,427	99,046	4,205	587,087	87	191,663	6,245	33,487	3,033	-
1883,	"	112	26	41,996	79,689	937,627	838	6,254	1,102	892,535	4	131,815	966	12,681	1,755	-
1884,	"	85	6,544	67,312	541,689	1,526	632	7,855	3,254	216,829	6	186,068	1,578	19,031	2,426	-
1885,	"	78	444	117,674	82,151	9,546	601	26,854	1,656	183,156	1	101,371	233	30,948	967	5,454
1886,	"	49	22	397,727	151,782	311	1,524	13,019	42	76,463	9	32,343	1,039	14,592	21,670	17,326
1887,	"	35	801	347,109	779,211	57	601	676	2,586	177,401	3	22,018	457	14,206	30,416	4,708
1888,	"	142	92,010	468,934	734,374	94,310	1,349	7,704	2,027	633,627	2,172	199,546	1,314	30,738	18,701	82,049
1889,	"	208	4,533	401,445	357,054	202,094	1,421	4,062	4,545	271,017	157	55,718	2,576	85,745	199,360	80,008
1890,	"	183	1,448	174,213	686,948	239,474	1,980	2,289	1,141	209,863	1,488	181,401	754	29,960	81,979	94,448
1891,	"	94	8,308	161,363	315,641	43,624	229	489	535	163,750	89	55,254	80	26,824	10,336	24,324
1892,	"	91	214	444,024	967,567	1,827	422	1,938	260	688,119	1	48,100	59	75,614	14,220	23,711
1893,	"	121	910	291,481	1,120,514	52,495	1	141	1,391	801,363	71	56,381	75	66,577	382	106,561

FISH AND GAME.

[Dec.

Comparison of Returns for the Years 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895 and 1896—Concluded.

Year.	FISHERIES.		Shad.	Alewives.	Sea Herring.	Menhaden.	Striped Bass.	Scup.	Bqueleague.	Mackerel.	Spanish Mackerel.	Bluefish.	Tautog.	Flounders and Flatfish.	Squid.	Other Edible or Bait Fish.
	Kind.	No.														
1882,	Other fresh-water seines, .	25	897	1,558,659	-	-	234	-	-	-	-	-	-	-	-	-
1883,	" "	23	391	1,762,950	-	-	1,072	-	-	-	-	-	-	-	-	-
1884,	" "	13	22	610,847	-	-	897	-	-	-	-	-	-	-	-	-
1885,	" "	13	3	1,296,449	-	-	-	-	-	-	-	-	-	-	-	-
1886,	" "	7	300	797,365	-	-	-	-	-	-	-	-	-	-	25,275	-
1887,	" "	5	-	454,409	-	-	-	-	-	-	-	-	-	-	11,520	-
1888,	" "	19	6	1,026,042	-	-	4	-	-	-	-	-	-	1,053	6,068	-
1889,	" "	8	-	513,001	-	-	-	-	-	-	-	-	-	-	-	-
1890,	" "	6	-	738,310	-	-	-	-	-	-	-	-	-	-	-	-
1891,	" "	9	-	1,251,994	-	-	-	-	-	-	-	-	-	-	-	-
1892,	" "	5	-	794,936	-	-	-	-	-	-	-	-	-	-	-	-
1893,	" "	5	-	645,613	-	-	-	-	-	-	-	-	-	-	-	-
1894,	" "	9	7	1,003,947	-	-	-	-	-	-	-	-	-	-	-	-
1895,	" "	5	-	491,084	-	-	-	-	-	-	-	-	-	-	-	-
1896,	" "	6	-	709,774	-	-	-	-	-	-	-	-	-	-	-	-
1882,	Total returns, .	261	44,734	4,446,280	1,512,060	8,735	5,929	2,090,526	71,471	8,876,599	397	325,478	46,757	148,380	7,049	-
1883,	" "	239	15,160	4,178,682	418,605	4,985,649	5,080	1,854,837	93,773	5,149,025	250	191,997	36,807	197,068	7,116	-
1884,	" "	205	17,699	2,353,781	3,347,892	309,907	7,582	1,648,984	78,080	1,657,315	105	245,762	30,507	307,971	36,406	-
1885,	" "	184	25,347	3,747,750	6,546,770	15,801	1,881	1,267,484	19,402	2,826,346	25	183,946	47,464	348,080	8,708	134,152
1886,	" "	124	19,466	3,183,741	1,520,466	49,221	3,936	1,979,262	3,268	1,395,850	29	55,031	48,678	276,187	58,872	590,659
1887,	" "	112	19,292	3,108,642	2,345,632	97,510	1,833	2,144,973	18,357	1,057,565	112	66,422	99,065	320,220	50,071	818,639
1888,	" "	264	149,200	3,767,929	7,669,493	1,556,036	3,275	1,672,610	129,850	3,801,393	2,489	240,874	70,623	432,710	40,634	2,875,420
1889,	" "	352	40,461	3,617,929	14,919,159	4,326,352	6,414	1,335,821	40,642	1,161,107	694	75,695	72,684	327,984	221,583	2,015,993
1890,	" "	291	29,303	3,038,920	6,482,120	6,931,804	7,282	356,712	45,130	1,507,617	2,730	242,034	26,391	240,920	102,789	1,112,320
1891,	" "	202	37,346	4,954,822	11,108,745	4,500,052	1,642	3,160,935	99,284	3,209,564	412	83,609	33,556	416,240	83,977	594,118
1892,	" "	193	16,928	3,179,923	17,241,072	128,744	2,273	2,423,923	70,345	5,394,352	48	64,396	45,940	423,541	88,194	1,620,997
1893,	" "	235	18,474	4,155,576	19,760,292	4,277,520	562	2,216,547	306,287	2,585,086	2,082	72,223	34,969	350,749	2,643,505	1,598,571
1894,	" "	309	12,684	5,693,300	16,321,847	1,652,078	2,207	394,237	302,325	4,893,911	1,451	100,141	28,918	256,881	2,094,185	8,914,569
1895,	" "	265	36,830	2,805,594	24,363,699	1,331,370	2,679	1,465,987	147,454	1,140,756	61	49,573	436,090	463,503	3,075,426	13,756,795
1896,	" "	307	25,154	4,629,110	18,470,855	736,244	1,713	3,664,067	270,432	2,371,444	98	78,984	42,451	401,882	3,836,545	4,498,824
	Increase of 1885 over 1884,	-	7,648	1,393,969	3,198,878	294,106	5,701	381,500	58,678	1,169,031	80	111,816	16,957	40,059	27,698	-
	Decrease of 1885 below 1884,	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-

FISH AND GAME.

Increase of 1886 over 1885, Decrease of 1886 below 1885,	60	5,881	564,009	5,026,304	33,420	2,006	711,778	16,134	1,430,496	4	78,916	1,214	71,843	50,164	456,507
Increase of 1887 over 1886, Decrease of 1887 below 1886,	12	174	75,099	825,166	48,289	2,103	165,711	15,089	338,285	83	11,391	40,387	44,033	8,801	227,980
Increase of 1888 over 1887, Decrease of 1888 below 1887,	152	129,908	642,287	5,323,861	1,438,526	1,442	472,363	111,493	2,743,828	2,377	174,452	18,542	112,490	9,437	2,556,781
Increase of 1889 over 1888, Decrease of 1889 below 1888,	88	106,739	150,000	12,249,666	2,790,316	3,139	336,789	89,208	2,640,286	1,795	165,179	2,111	104,726	180,949	859,427
Increase of 1890 over 1889, Decrease of 1890 below 1889,	61	11,168	579,009	14,437,039	2,605,452	868	979,109	4,488	346,510	2,036	166,339	46,243	87,064	118,794	903,673
Increase of 1891 over 1890, Decrease of 1891 below 1890,	89	2,492	1,915,902	5,626,625	2,431,752	5,640	2,804,223	53,754	1,701,947	2,318	158,425	7,165	175,320	18,812	518,202
Increase of 1892 over 1891, Decrease of 1892 below 1891,	9	20,418	1,774,899	6,132,327	4,373,252	631	737,012	28,939	2,184,788	364	19,212	12,384	7,301	45,783	1,026,879
Increase of 1893 over 1892, Decrease of 1893 below 1892,	42	1,546	975,653	2,519,220	4,150,776	1,711	207,376	235,942	2,809,266	2,034	7,827	10,971	72,792	297,805	22,426
Increase of 1894 over 1893, Decrease of 1894 below 1893,	74	5,790	1,537,724	3,438,445	2,625,442	1,645	1,822,310	3,962	2,308,825	631	27,918	6,051	93,868	549,320	7,115,998
Increase of 1895 over 1894, Decrease of 1895 below 1894,	44	24,146	2,887,706	8,041,852	320,708	472	1,071,750	154,871	3,753,155	1,390	50,568	407,172	206,622	981,241	4,842,226
Increase of 1896 over 1895, Decrease of 1896 below 1895,	42	11,676	1,823,516	5,892,844	595,126	966	2,198,080	122,978	1,280,688	37	29,411	393,539	61,621	761,119	9,257,971

PUBLIC DOCUMENT

. . . . No. 11.

ANNUAL REPORT

OF THE

BOARD OF HARBOR AND LAND COMMISSIONERS

FOR THE YEAR 1896.

BOSTON:

WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.

1897.

Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1896, covering a period of twelve months, from Nov. 30, 1895.

HEARINGS.

The Board has held one hundred and sixty-six formal sessions during the year, at which one hundred and eighty-three hearings were given. One hundred and twenty-one petitions were received for licenses to build and maintain structures, and for privileges in tide waters, great ponds and the Connecticut River; of these, one hundred and fifteen were granted, four withdrawn and two denied.

On June 5, 1896, a hearing was given at Buzzards Bay on the petition of the town of Wareham that the boundary line on tide water between the towns of Wareham and Bourne at the highway bridge across Cohasset Narrows, as defined by the Board under chapter 196 of the Acts of 1881, be marked on said bridge.

On June 20, 1896, a hearing was given in Nantucket on the petition of the local board of health for license to fill a dock.

On June 23, 1896, a hearing was given in Vineyard Haven on the matter of boundary line between the towns of Gay Head and Chilmark, pursuant to chapter 187 of the Acts of 1896.

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On July 11, 1896, a hearing was given in Provincetown in regard to the occupation of the Province Lands.

All other hearings were given by the Board in Boston.

Many important matters pending before various committees of the Legislature during the last session have required the attendance of the Board, and demanded careful study and consideration of the interests of the Commonwealth.

SOUTH BOSTON FLATS.

The work of filling and improving the tide-water lands known as the Commonwealth's flats at South Boston has been confined to a general care of the property and a supervision of the deposits, also to the cremation of the rubbish and other material brought in carts for which a free dump is desired. The solid part of this material has been used in surfacing a portion of the area which was filled by hydraulic dredging, and also in filling some holes along the bulkheads protecting the northerly and easterly sides of the seventy-acre lot where the filling had been washed out by the sea during heavy storms.

The property generally, including the sewers, is in excellent condition. The streets, however, other than Congress Street between B and C streets, although filled to grade, have not been paved or otherwise surfaced to prepare them for teaming.

The development of the lands has been retarded by the uncertainty existing as to the future of Congress Street, about which the New England Railroad Company, the city of Boston and the Commonwealth had been unable to reach an agreement. A special grade crossing act passed last winter, being chapter 535, Acts of 1896, authorized a commission to hear the parties interested and determine what should be done in the matter. That commission has been sitting and has proceeded so far as to determine that the portion of Congress Street crossing the land of the railroad company shall be discontinued, and that a new street starting at the intersection of the extension of Summer Street with the harbor line on the westerly side of Fort Point Channel shall cross Fort Point Channel and the intervening land at an elevation and join Congress Street at about its junction with C Street,

there making a slight angle. The width of the new street will be 100 feet and its highest elevation will be 24.5 feet in crossing the railroad tracks, from which it will descend at grades of from 1.5 per cent. to 1.75 per cent. to the level of existing streets.

It has also been determined to broaden Congress Street from L Street bridge to a point just east of C Street to a width of 100 feet; also to build a side approach to Congress Street 80 feet wide along the harbor line on the Boston side of Fort Point Channel; and to widen Congress Street to 80 feet from the harbor line to Atlantic Avenue. On the South Boston side a lateral approach is to start near the harbor line and to follow substantially the location of the tracks of the New England Railroad to A Street. After passing on to the Commonwealth's property another lateral approach is to start at D Street and follow D Street to Fargo Street, thence to C Street. A bridge is to span B Street 60 feet wide, with 19 feet headroom, and another at C Street 80 feet wide, with a minimum headroom of $16\frac{1}{2}$ feet. This elevated street it is feared may occasion damage to all of the Commonwealth's land, but more particularly that portion in its immediate vicinity, because this street is the only one affording direct communication with the business heart of the city, and provision for approaching it at two points only has been laid out by the Commissioners, — one on Congress Street about 268 feet east of E Street, the other at the corner of C and Fargo Streets. This last street is only 50 feet wide and is the only outlet over the new street provided for the 100 acres of the Commonwealth's property south of Congress Street and north of West First Street.

The other streets now connecting with Congress Street, viz., B, D and E Streets, will be left at the points of intersection from 6 to 24 feet below the grade of the new street, and will have to be filled by the Commonwealth to make graded approaches. The result of this will be to create a high causeway across the middle of the lands to which the side streets will have to be graded at more or less expense. Doubtless the work of construction will proceed as rapidly as possible on this new street, but until it and its approaches and the new bridge across Fort Point Channel to connect it

with Summer Street shall be nearly completed, the land will fail to present the desired attractiveness for building purposes for which it is so well adapted. The same commission is also charged with the duty of determining in what proportions the cost of this grade crossing shall be borne by the respective parties. The Commonwealth's interests have been most carefully guarded throughout the hearings by the Attorney-General's department, to which this Board has given every and all assistance and information within its power.

Another fact affecting these lands of the Commonwealth was the passage of the Southern Union Station Act, being chapter 516, Acts of 1896, whereby ten wharves, covering one-half mile of water front on Fort Point Channel, have been forever barred to maritime purposes. The operation of the two statutes prohibits the contemplated extension of Mt. Washington Avenue as a thoroughfare through the hundred-acre parcel between Congress and West First streets, and will compel all traffic from this district to seek an outlet through one or the other of the aforementioned streets.

It is fair to presume that the conditions are now fixed under which the filled lands at South Boston may be developed without further interference from the railroads. There are about 177 acres of these lands, of which about 70 will lie north of the new elevated street. Of this a strip of say perhaps 150 feet in depth, fronting southerly on the new street, may be sold for warehouses or mercantile purposes, in the rear of which lies a large tract of many acres bounded on the north by the harbor and on the west by the railroad property. This tract is particularly well located with its large water front for maritime purposes and is already attracting attention. No land is better located for improvement for wharf and dock purposes than that lying adjacent to the railroad premises.

Now that the action of the New York, New Haven & Hartford Railroad Company has cut off all approaches along the western side of this great property of the Commonwealth for seven-eighths of a mile between First Street and the proposed Northern Avenue to one street, and that one elevated over the railroad to a height of 24.5 feet above the general

level, it becomes imperative to proceed with the construction of Northern Avenue across the railroad property and with the building of Oliver Street bridge. Otherwise the seventy acres north of Congress Street will be practically bottled up, and it would be idle to contemplate development by improving the wharf frontage with no outlet at grade for the heavy traffic incident to commercial trucking, and no opportunity of reaching the warehouses and wholesale marts of the city without travelling three sides of a square and elevating a load 24.5 feet in the air, instead of a short straight line at grade.

The time has come which must decide whether the wharf frontage of the Commonwealth's property is to be made valuable to the public or be neglected for lack of due and proper approaches.

The Board recommends that provision be made for laying out and building Northern Avenue across the property of the New England Railroad Company and for the construction of a bridge in continuation thereof across Fort Point Channel to the city proper, thereby connecting the proposed docks and piers on the Commonwealth's property with the business portion of the city by a practically level street.

The plan appended shows the proposed bridge and Northern Avenue, so laid out as to connect at grade with the projected docks and wharves. It shows the avenue on the Commonwealth's lands at a width of 150 feet, as being the proper width in the light of modern requirements for an avenue at the head of wharves of the proposed class. The proposed Northern Avenue will necessarily be at grade with the railroad tracks. Its purposes are to supply additional conveniences for delivering and shipping merchandise at the proposed docks and wharves by both rail-haul and truckage, and to afford more direct and shorter communication at grade with the business centres of the city and with connecting railroads. Its uses would naturally be confined to heavy teaming and railroad transportation such as is connected with loading and discharging steamships. It can never be expected or desired that it will be a pleasure drive, and its establishment at grade should be secured beyond fear of change and the expense incident thereto.

In October last an agreement was made with L. G. Burnham & Co. for the occupation of about $6\frac{1}{2}$ acres of the filled land on the northerly side of Congress Street near the L Street bridge, extending from Congress Street to within 50 feet of the bulkhead on the northerly side of the filled flats. The agreement provides for a lease for the term of fifteen years, to be executed as soon as legislation is passed clearly defining the powers of the Board in the matter. The rental agreed upon will give the Commonwealth a fair return for the money expended in reclaiming the land and in making the proposed improvement, and is so graduated that upon the termination of the lease the rate then being paid will be a fair return upon the anticipated enhanced value of the property. The Commonwealth agrees to build an oak pile wharf 400 feet long, and to dredge a channel 75 feet wide and 18 feet deep at mean low water from alongside the wharf to the main channel of the harbor. Mr. Burnham proposes to erect on the premises the buildings, elevators, plant and machinery necessary for carrying on a large coal business, and is to make all repairs and do all additional dredging required by him during the term of the lease. A contract * has been made with the New England Dredging Company, dated Oct. 22, 1896, for dredging the channel, for the sum of \$13,945; and a contract † with Albert A. Hersey, dated Oct. 19, 1896, for building the wharf, for the sum of \$7,438, and work is progressing under both contracts. The property to be leased is that portion of the filled flats which is most remote from Fort Point Channel, but is at grade with the new Congress or Summer Street. A number of sales have recently been made on the south side of the Reserved Channel, and it is expected that the movement may extend to these Commonwealth's lands in the near future.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1895, was \$27,450.06. To this has been added during the year \$574.45 from the income of the fund, \$2,988.90 from rents of land, and \$50,000 paid into the fund from the treasury of the Commonwealth under the provisions of chapters 442 and 548 of the Acts of

* See Appendix A.

† See Appendix B.

1896, making a total of \$81,013.41. Of this sum there has been expended during the year \$5,637.84, leaving an available balance on Nov. 30, 1896, of \$75,375.57. An estimate of \$400,000 to be paid into the Commonwealth's flats improvement fund was submitted through the Auditor's department with the estimates for other purposes. It is proposed to use this amount in the construction of a pier and dock on the northerly front of the Commonwealth's property.

The Board recommends that section 3 of chapter 19 of the Public Statutes, relating to leasing portions of the Commonwealth's property at South Boston, be amended so as to more clearly define the powers of the Board in relation thereto.

SURVEYS, ETC.

The work on the Commonwealth's flats at South Boston has occupied much less of the time of the engineering force of the Board than for a number of years past, and has enabled the Board to carry on more general work than usual.

The triangulation for a resurvey of Mystic River from Chelsea bridge to the Medford line, which was begun last year, was completed in December, 1895, and January, February and March, 1896, including the calculation of the geographical positions of the stations located. Twenty-eight stations were occupied and the positions of one hundred and nine stations were determined.

Four plane table sheets were prepared for field work, and in July, during a lull in other work, the territory covered by a part of one sheet was surveyed and plotted on a scale of $\frac{1}{1000}$ uniform with the other sheets of the harbor resurvey. This work will be continued as opportunity offers.

In March surveys were made to correct and bring up to date the wharf lines on the plane table sheet of Fort Point Channel between the New England Railroad bridge and Federal Street bridge, including the wharves to be taken in carrying out the proposed plans for a Southern Union Station.

In May and June surveys were made to correct and bring up to date the wharf lines on the plane table sheet of the portion of East Boston lying between the Atlantic Works and Meridian Street bridge, and also on the sheet covering

the portion of South Bay between Roxbury Canal and the New England Railroad.

In April and May soundings were taken off the Grand Junction wharves at East Boston and opposite the Mystic wharves at Charlestown, on which to base the plans and estimates for letting the contracts for dredging the shoals there.

In November soundings were taken over a portion of the area opposite the Mystic wharves which had been dredged during the summer. The work of dredging at this place and also opposite the Grand Junction wharves at East Boston has been frequently inspected and lines and grades marked to govern the work, the marks being renewed whenever necessary, and all material sent to sea has been accompanied by an inspector to be sure that it was dumped at the proper place.

In September soundings were taken over a portion of the South Boston flats for the purpose of preparing plans and estimates for the channel to be dredged under the provisions of the agreement with Mr. L. G. Burnham, and plans and specifications were prepared for the work and for the construction of the oak pile wharf which was also provided for in the same agreement.

In June a survey was made of the shore line and structures in Cohasset Narrows from the New York, New Haven & Hartford Railroad bridge to Buttermilk Bay, for the purpose of locating and defining a portion of the boundary line between the towns of Bourne and Wareham.

In the same month a survey was made of Menamsha Inlet, a portion of the boundary line between the towns of Gay Head and Chilmark. Copies were obtained from the United States Coast and Geodetic Survey at Washington of the plans of its surveys of this territory in 1845-46 and 1888, and a copy was obtained of the plan made in 1855 by Jeremiah Pease, showing the line established by the Legislature by chapter 204 of the Acts of 1856. Copies of these plans were made on the same scale as our plan in order to compare them with each other, and from these a plan has been made showing the changes which have occurred between the dates of the various surveys.

In July and August we began a topographical survey of the Connecticut River and its banks, under the appropriation made by chapter 77 of the Resolves of 1896. The location of the triangulation stations established in its town boundary survey along the river from Springfield to North Hatfield was obtained from the Massachusetts Topographical Survey Commission. From these twenty-six stations near the river bank were established by triangulation, covering the territory from a point just above the islands opposite Mt. Holyoke to North Hatfield, and based upon these stations the topography for about 5 miles in length of the river between portions of Northampton and Hatfield on one side and of Hadley on the other has been surveyed and plotted on a plane table sheet on a scale of $\frac{1}{5000}$. Some apparent great transformations are taking place in this section, owing to the caving banks, and would have included the bank in Hadley had it not been protected by the Commonwealth in 1888 and 1889.

In addition to the above, a number of partial surveys of wharves have been made as a basis for calculating the amount of tide water displaced in carrying out the work licensed by the Board.

The work of repairing, mounting old plans, and of arranging and indexing the plans in the office has been continued during the year, but has been hindered by lack of room for arranging the plans.

HARBORS.

Boston harbor is the first in importance in the Commonwealth and the second only in the United States. Its welfare and its improvement to a point which will enable the commerce there carried on to be transacted in a convenient and economical manner are matters of the highest consequence not only to the city and the State but to the country at large. As a distributing and transfer station in the highway of commerce, it is important that it should enjoy all the facilities and conveniences for economical handling and forwarding.

To the attainment of these objects and to the enhancement of safety in navigating the water-ways of the harbor, the

work of the Federal government is in entire accord with the purpose of the Commonwealth.

The work of the War Department in removing rocks and ledges from the main ship channel has progressed slowly during the past year. The location of the work is very exposed and it is necessary to tow the working plant into sheltered anchorage whenever the wind blows heavily, thus losing much valuable time. A considerable quantity of the rock removed has been used in protecting the shores of Gallop's Island and Long Island.

In pursuance of a long-established policy, the Legislature at its last session appropriated \$150,000 to be used in excavating the bottom of the harbor off the wharves beyond the lines of excavation to be done by the Federal government, and thus insure to the modern steamship a sufficient depth of water in which to float without grounding between her dock and the main channel. Immediately proposals for dredging were invited and a contract * was made June 11, 1896, with the New England Dredging Company to dredge about 127,000 cubic yards from the shoal in front of the Grand Junction wharves at East Boston for the sum of \$48,280. The completion of this contract this season will

allow water from the main channel to the dock owners do their own dredging, at Boston frontage at present used for large ocean steamships.

Another contract was made July 8, 1896, with the East-ay, for the sum of \$89,225, to dredge 18,000 cubic yards between the main Wharf at Charlestown, where a large capacity of 1,750,000 bushels, is situated, nearly done and will provide a depth in low water out to the main channel. A depth of 23 feet at mean low water was the largest vessels, and it was all that government contracts. Now, however, a mean low water is made necessary by the vessels of the largest class, and even then to spare under the keel.

† See Appendix D.

In the River and Harbor Act passed by Congress June 3, 1896, provision has been made for improving the harbor at Boston and many other places in the Commonwealth. At Boston \$70,000 is appropriated for its preservation, and for continuing the improvements, and authority is given to contract for the completion of the project of 1892 for widening the main ship channel to a minimum width of 1,000 feet and a minimum depth of 27 feet at mean low water, at an expenditure under the continuing contract system not to exceed the further sum of \$1,145,000. Proposals for bids are already invited, and there is every reason to believe the work will be vigorously prosecuted in the spring and pursued to consummation.

Appropriations for improving the rivers and harbors elsewhere in the Commonwealth to the amount of \$359,000 have been made as follows, viz.:—

Improving harbor at Lynn: continuing improvement, \$20,000.

Improving harbor of refuge at Nantucket: continuing improvement, \$20,000.

Improving harbor at Plymouth: completing improvement, \$1,500.

Improving harbor at Provincetown: completing improvement, \$1,500.

Improving harbor at Newburyport: continuing improvement, \$16,000.

Improving harbor at Scituate: continuing improvement, \$6,000.

Improving Stage Harbor at Chatham: completing improvement, \$5,000.

Improving harbor at Hyannis: continuing improvement, \$6,000, of which sum \$2,500 shall be expended for dredging.

Improving harbor at Vineyard Haven: continuing improvement, \$7,000.

Improving harbor of refuge at Sandy Bay, Cape Ann: continuing improvement, \$150,000.

Improving harbor at Gloucester: continuing improvement, \$34,000.

Improving Woods Holl Channel, \$20,000.

Improving New Bedford Harbor: continuing improvement, \$10,000.

Improving Powow River: continuing improvement, \$12,000.

Improving Taunton River: continuing improvement, \$5,000.

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Improving Weymouth River: continuing improvement, \$15,000, of which \$10,000 shall be used in the improvement of Weymouth Back River.

Improving Essex River: continuing improvement, \$5,000.

Improving Mystic and Malden Rivers: continuing improvement, \$10,000.

For the improvement of the channel of the Merrimac River, \$5,000.

Improving Town River, \$10,000.

Also preliminary examinations are ordered to be made in this State as follows, viz.: —

Salt Pond and Herring River, in Harwich.

The approaches to the Cape Cod ship canal.

Gurnet Rock and other rocks at mouth of Plymouth harbor.

Duxbury Beach, with view to protection of harbor.

Duxbury Harbor, with view to widening and deepening improvement.

In addition, surveys are ordered to be made and cost of improvement to be estimated: —

Merrimac River, from Lowell to New Hampshire State line.

Marblehead harbor, with a view to improving the harbor by building a sea wall to protect the isthmus connecting Marblehead Neck with the town of Marblehead.

Provincetown harbor, with a view of erecting a dike for the protection of that harbor.

Neponset River.

Channel in New Bedford harbor leading to the bridge between that city and Fairhaven, with a view to determining what amount of dredging would be necessary to make the change in the draw in said bridge from the west to the east side of Fish Island practicable and advantageous.

Lynn harbor, with a view to securing a channel 300 feet wide and 15 feet deep at low water.

Boston harbor, with a view to securing a channel 1,200 feet wide and 30 feet deep from the Navy Yard to the entrance of the present main ship channel, and from the main ship channel in Presidents Roads through Broad Sound Channel.

Mount Hope Bay and Fall River harbor.

Manchester harbor.

Connecticut River, between Holyoke and the foot of the Enfield rapids.

Plymouth harbor.

Weymouth Back River, from Hingham bridge to Mann's Wharf.

The provision for surveying a channel from the Navy Yard 1,200 feet wide and 30 feet deep through the main ship channel and thence through Broad Sound Channel is the first fruit of the effort started over a year ago. The survey will doubtless be made and the Congress of 1898 will be asked to make the necessary appropriation to give the harbor of Boston an entrance adequate for the accommodation of her growing commerce, and without which the highest possibilities of the port cannot hope to be realized. Already, it is said, the Germans are building steamships of 20,000 gross tonnage with a length of 650 feet,—that is, 100 feet longer than the width of the passage at “the Narrows” between Lovell's and Gallop's islands. We have seen that the last Congress has enabled the War Department, by means of the continuing contract system, to arrange for completing the project of August, 1892, for a channel 1,000 feet wide and 27 feet deep. At the same session, however, such has been the stride in increased size of steamships, authority is given to survey for a channel 1,200 feet wide and 30 feet deep, to the Navy Yard. Hardly is this in print before the Board is informed by the Warren Line people that they are expecting to replace the steamships of their line now sailing from this port with others of the largest type, and that greater depth of water will be needed over Man-of-War shoal to take the new vessels to the Hoosac Tunnel docks with safety. It is therefore recommended that the Federal government be asked to carry the project of a channel 30 feet deep not only to the Navy Yard, as proposed, but beyond to Charlestown bridge and to the junction of Chelsea Creek with Mystic River, to the end that all the railroad terminals may have a clear water-way of sufficient depth to float the largest steamships from the wharves to the sea.

Another object lesson on the inadequacy of the present ship channel was given by the grounding of the steamship “Roman” of the Warren Line on George's Island, Oct. 2, 1896, on her way to sea with a full cargo, while endeavor-

ing to avoid a drifting scow supposed to have dynamite on board. She grounded hard and a considerable portion of her cargo had to be removed before she floated. In this connection, attention is again called to the danger of permitting long tows within the harbor limits whereby liability to damage to steamships by grounding in an effort to avoid them or to the barge in tow or the person of some one on board, is needlessly incurred. It is recommended that some legislation be passed, putting the regulation of this matter in charge of some competent agency.

Since making the last report, the committee on Rivers and Harbors of Congress, as guests of the city of Boston, visited the harbor and the Navy Yard at Charlestown. They enjoyed the hospitality of the Leyland Line on board the steamship "Cestrian" on her way down the harbor on her first voyage to Liverpool in March last. From her lofty deck they had a bird's-eye view of the passages, channels and narrows, and at sight were convinced of the importance and value of the proposed Broad Sound Channel, of which evidence was given by the ensuing legislation wherein the appropriation was made for a survey. They also visited the Navy Yard and were impressed with the facility with which a new large dry dock might be built in the immediate vicinity of the present one at a comparatively small cost for the class of structure desired.

The opening by Federal authority of Richford, Vt., last summer as a place for examination and passage of Canadian cattle was immediately felt in the demand for their transportation through Boston to Liverpool. This demand, though checked for a while by the action of the government, has been growing steadily since 1877, when the number of cattle exported was only 1,566, up to the past year of 1896, in which there were shipped from the port of Boston 161,008 cattle and 124,185 sheep. These figures show 36,887 cattle and 34,230 sheep more than were exported through New York in the same time, thus ranking this port as the first in the country on cattle shipments. This rank can be maintained if wharf accommodations and depth of water-ways are provided by the fostering care of the Federal government and the Commonwealth, supple-

mented by the business sagacity and enterprise of the merchants.

Owing to the short crops abroad and to the abundance at home, shipments of grain have been larger the past year than ever before, and it may safely be said that while improvements for the purpose of diminishing the cost of handling grain have been put into practice elsewhere in this country, no port is better fitted to-day to cheaply handle and ship grain than is the port of Boston.

Experience has demonstrated that large vessels can be more economically used in the carriage of merchandise than small or moderate sized ones. Hence the advent of the great steamers "Victorian," "Sylvania," and "Canada," now running between Boston and Liverpool. Owing to the greater draught of this new class of steamships, measuring as they do 15,000 registered tons and drawing from 27 to 30 feet of water, as we have before said, deeper water-ways are required.

The commerce of the port is steadily increasing and, including foreign and coastwise, reached the large figures of 8,000,000 tons for the year ending June 30, 1896. Its value is also growing at a rapid rate, the exports alone having risen from \$33,886,495 in 1875, to \$100,000,000 during the year ending Sept. 30, 1896. This increase in value denotes a constantly expanding export in manufactured goods both in volume and variety. It will surprise many to learn that Boston is the third meat-packing city in the country, coming next to Kansas City in the quantity and value of the meats packed here for export. A perusal of the annually published list of exports by the Warren Line steamships would reveal an unknown market to many whose lines of business do not familiarize them with the character and extent of the manufactured articles which are sent abroad.

SOUTH BAY.

This bay lies at the head of Fort Point Channel and has been growing in importance commercially for several years past. Time was when the idea of filling it was entertained. Since then, however, its value as an inland basin, giving opportunity for the conveyance by water of the coarser com-

modities and bulkier merchandise nearer to the place of consumption, has become recognized. Gradually and in response to slow-growing demand it is found to be convenient and serviceable as well as economical, and its preservation as an open water-way is no longer questionable.

The destruction of ten wharves and the subversion of one-half mile of water frontage on Fort Point Channel by the location of the Southern Union Passenger Station has driven off lumber, coal and other merchants from the premises taken for railroad purposes and compelled them to look elsewhere for a place for doing business. This has led to fresh interest in the possible accommodations of South Bay and a renewed application by the Roxbury Central Wharf Company for a license to improve its property by dredging and filling and building additional wharves.

It is in the interest of the public that every proper encouragement should be given to parties endeavoring to improve the inland water-ways and basins for the uses and purposes of commerce, and by so doing incite a healthy competition with other means of transportation. Incidentally also if trucking and teaming through the thoroughfares of the city is saved, by just so much is crowding and congestion diminished.

GREEN HARBOR.

July 15, 1896, the joint board, consisting of the Harbor and Land Commissioners and the State Board of Health, organized under chapter 495, Acts of 1896, with Dr. Henry P. Walcott as chairman, for the purpose of taking action relative to the restoration of Green Harbor in the town of Marshfield, and appointed as its engineers to conduct the required examination, Frank W. Hodgdon, engineer of the Board of Harbor and Land Commissioners, and Xanthus H. Goodnough, engineer of the State Board of Health.

An inspection of the locality was made by the joint board on July 21 and 22, in which an examination was made of the mouth of the river and of the basin that would be flowed by the removal of the dike.

Until the report of the engineers has been received and acted upon there is nothing further to be reported relative to this subject.

GREAT PONDS.

By chapter 318 of the Acts of 1888 this Board was given jurisdiction over great ponds containing in their natural state more than ten acres, and empowered to grant licenses for structures and other work, and to prevent by injunction or otherwise any unauthorized encroachments.

Since the passage of this act numerous applications for rights and privileges have been received, some of which have been granted subject to restrictions, and others denied. It is suggested that an appropriation be made for obtaining reliable data, by surveys and otherwise, in respect to the location, areas, and other matters connected with the great ponds belonging to the State, for the benefit of the Commonwealth and for the purpose of aiding this Board in its work.

BOUNDARY LINE BETWEEN GAY HEAD AND CHILMARK.

Chapter 187 of the Acts of 1896 empowered the Board of Harbor and Land Commissioners to examine, define and determine the boundary line between the towns of Gay Head and Chilmark.

Under chapter 15 of the Resolves of 1855, commissioners were appointed "to establish the boundary line between the lands of said Indians (Gay Head) and the lands of the white inhabitants of Chilmark, in Dukes County." These commissioners reported to the Legislature in February, 1856 (House Doc. 48, 1856), in part, as follows: "Thence, north fifty and one-quarter degrees east, crossing said Menamsha Pond, in the direction of a rock upon Pease's Point, so called, distant about four hundred and fifty rods, until it strikes the middle of the channel, or outlet, from said pond to the Sound; then, by the middle of the said channel, or outlet, as the same now is, or hereafter may be, — the said channel being somewhat subject to change, — unto the Vineyard Sound."

A map showing the boundary line as run and established, drawn by Jeremiah Pease, surveyor, was filed with this report.

By chapter 204 of the Acts of 1856, the boundary line as

laid down and described in the above report was established and confirmed.

By chapter 213 of the Acts of 1870, the district of Gay Head was abolished and the town of Gay Head incorporated.

By chapter 10 of the Resolves of 1875, the subject of the improvement of Menamsha Creek and Pond was referred to the Board of Harbor Commissioners for examination and report to the next Legislature.

In the report for 1875 the Board says: "According to the early history of this creek, its outlet was farther eastward than it has been since, and near where the beach joins the upland. About 1770 it either broke, or was dug 'square out' in the alignment of the main trend of the creek. This new channel, or outlet, gradually worked to the westward, ran crookedly through the beach, grew more shallow, and in the year 1842 closed up. In April, 1843, by volunteer labor, a new inlet was again dug through the beach 'square out' as the report says. This cut remained as a good channel, having five feet of water in it, until the great gale of June, 1853. The action of this gale so injured the creek, that it has been gradually deteriorating since. The creek is now narrow and crooked in its pathway through the beach, the entrance is from one-fourth to one-third of a mile westward from the site of the original cut, and has but about one-half a foot of water in it at low tide. . . . The most favorable and suitable location for the proposed cut through the beach is not in a line at right angles with the trend of the outer beach, but one beginning on the inside at the bend of the creek and inclining slightly westward, so that the channel and current through it shall partially coincide with the natural outside currents and influences which tend in this direction."

May 1, 1883, the Harbor and Land Commissioners, pursuant to chapter 196 of the Acts of 1881, located and defined the boundary line on tide water between these towns as follows: "Beginning at the end of the boundary line between said towns as heretofore established, at the mouth of Menamsha Creek, and running north 29° west, . . . to the general division line of tide water in Vineyard Sound."

The portion of the boundary line in dispute being in the outlet of Menamsha Pond, the Board caused a topographical survey of this locality to be made and plotted. Upon it are shown the surveys made by the United States Coast and Geodetic Survey in 1845-46 and 1888.

An inspection of the premises was made by the Board on June 22, 1896, in company with the selectmen of both towns and their counsel, and a public hearing given in Vineyard Haven on the following day. Eight witnesses testified for Chilmark and four for Gay Head. The Board heard arguments of counsel in Boston, July 1, 1896.

The evidence tended to show that during the past sixty years the channel or outlet of Menamsha Pond has been travelling up and down the beach separating the pond from Vineyard Sound, having openings in different spots at different times, but all within a range of about 3,000 feet. Some of these openings were the operations of nature and some were caused by artificial means. For convenience, points of reference were located on the ground and marked on the plan by letters of the alphabet from a to g.

Witnesses testified that in 1836 the outlet was in the same place as at present; that in 1847 it was about at a; in 1855 about at b; in 1856 at b, c and d; in 1861 about at b; in 1862 about at b and a little west of b; in 1863 at b; in 1870 about at a and between a and b; in 1885 at a, and in 1891 between c and d; that in 1862 the old outlet was stopped up; in 1878-79 a bulkhead was built across the outlet and caused the same to turn toward the east; in 1885 the outlet was closed and an artificial one made; in 1895 it was dug through where the Board found it. It was obviously impossible to determine where the outlet would have been, had nature been allowed to have her course. It appeared that no controversy had arisen on account of the shifting nature of the boundary until the dispute about the right to locate fish pounds or weirs in 1892.

The Board is satisfied that a fixed boundary line will tend toward peace and quiet between both towns, and therefore has established a line on the old courses down to a point conveniently located for a straight and easily found course to the Sound, upon which the channel at some time

probably flowed, and could with no great difficulty and at no great cost be dug again if either town desired, and recommends that either town may so dig if it chooses, in which case the other town shall have no right to divert the channel from the course, to the end that the outlet of Menamsha Pond may be maintained upon the boundary line by either or both towns, if it or they so choose, forever.

The boundary line which the Board has defined and determined is as follows :—

Beginning at a rock on a neck of land known as Nicodemus' Neck, near the westward part of Squibnocket Pond,—the rock near Smelt Creek bearing north 30° east—Gull Island, a small island in the pond, bearing north 74° east; thence, due south, across the marsh and beach, unto the sea, or ocean. And from the same rock, south 55° east, across Squibnocket Pond, to a rock on Hillman's Point, so called, on Squibnocket; thence, north 10.5° east, crossing said pond, to the southern end of a stone wall on Nashawaqueedsee, which parteth that neck from Gay Head; thence, north 25° east, three rods, by said wall; thence, north 47.5° east, sixty-seven rods, by said wall; thence, north 26° east, three and three-quarter rods, by said stone wall, to its northern end, by Menamsha Pond. Thence, north $50\frac{1}{4}^{\circ}$ east, crossing said Menamsha Pond, in the direction of a rock upon Pease's Point, so called, distant about four hundred and fifty rods, until it strikes the middle of the channel, or outlet, from said pond to the Sound; thence by the middle of said channel or outlet, as the same now is, to a point marked A on the plan accompanying this report, distant 130 feet north 40° west (true meridian) from the stone bound to be placed on the south side of the old highway opposite Tilton's house, leading down to the shore; thence on the same course north 40° west 1,170 feet; thence north 29° west (true meridian) to a point in the general division line of tide water in Vineyard Sound as located and defined by the Board of Harbor and Land Commissioners pursuant to chapter 196 of the Acts of 1881; and the right is hereby granted to either and both the towns of Gay Head and Chilmark to dig, divert and maintain the outlet from Menamsha Pond upon the course from the aforesaid point

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A to the Sound, and to dam any other outlet then or thereafter existing.

WAREHAM AND BOURNE BOUNDARY LINE.

On May 25, 1896, a petition was received from the town of Wareham requesting the Board to mark on the highway bridge across Cohasset Narrows the boundary line on tide water between Wareham and Bourne as located and defined under chapter 196, Acts of 1881.

On June 5, 1896, after due publication of notice thereof, a public hearing was given at Buzzards Bay, the selectmen of both towns and the county commissioners of Plymouth County being present. Counsel in behalf of Bourne protested against any action being taken by the Board, claiming that the Board "has no jurisdiction in said matter, and no right or power to decide where the boundary line is on tide waters between said towns; that the question of where the boundary is between said towns is one that can alone be determined by the Legislature."

The boundary line which the town of Wareham wanted marked on the highway bridge at the point of intersection therewith was located and defined by this Board and a report made thereon in May, 1883, and filed with plans in the registry of deeds at Plymouth and Barnstable. It was defined as the boundary line between Wareham and Sandwich. Bourne was set off from Sandwich by chapter 127, Acts of 1884. At the locality where the bridge crosses the stream, the boundary line is described in the report aforesaid as "following the central line of Cohasset Narrows." The Board decided that it was its duty on the petition before it to find the location of the boundary line theretofore defined at the point on the bridge where it crossed the "central line of Cohasset Narrows," and to set a mark at that place for the purpose of ascertaining and showing where the boundary line between Wareham and Bourne is, and not with a view to altering an old or fixing a new boundary line. Accordingly the necessary survey was made and the "central line of Cohasset Narrows," where it was crossed by the bridge, was found, and a mark set thereon to indicate the boundary line at that point.

PROVINCE LANDS.

The experience of another year with the Province Lands shows most satisfactory results. While many of the shrubs and young trees perished, many again survived, and the beach grass planting demonstrates that it can be relied on to hold down the sand and prevent the movement that has endangered the forest growth, and which without restraint might ultimately threaten the town.

It is obvious that the work of planting with beach grass must be first, and then that must be followed up by planting shrubs and trees of rapid growth, interspersed with those of slow growth, before the labor of planting shall be completed. Experiments are making in the nursery and in the open for the purpose of ascertaining what kinds of shrubs and trees are best adapted for growth and development under the exposed conditions inseparable from this locality. It is hoped that some species of the willow may find here congenial soil, or that some pine, by a yield of pitch, may in a measure help bear the cost of maintenance. That, however, is not a question of the immediate future, and can be brought forward and discussed after we have succeeded in finding the growth best adapted to the prevailing conditions.

The Board made two visits to Provincetown during the year, one in July and one in October, to renew directions and observe the work carried out under the appropriations of the last Legislature. There are certain persons who claim that they have, by long occupation and improvement, a moral right to enjoy the fruits of certain parcels of the Province Lands, and that the passage of chapter 470 of the Acts of 1893 was not intended to oust them from their possessions, but that they have a right to go on pasturing cows, cutting hay and cultivating cranberries as of yore. Thus far the Board has avoided an open rupture with these people by dealing gently with them, permitting them to go on largely as before, but narrowing their enjoyment and occupying the premises claimed by them when wanted for immediate use for planting. The Board held a public meeting at the town hall in Provincetown, in July, and listened

to the claims presented, and announced to the claimants that their possessions were only at sufferance, and would have to give way as the requirements of planting developed. Meanwhile the Board had caused to be posted a warning* against the destruction of any vegetable growth on the Province Lands under penalty of trespass. As fast as it can conveniently be accomplished without open violence, these possessions, however, will have to be yielded up for tree planting.

The discussion of further details relating to the care and management of the lands and the nature of the vegetation best suited to bind the sand and produce a mature growth would be little more than a repetition of the subjoined reports of the Superintendent and the Landscape Engineer to the Board.

REPORT OF THE SUPERINTENDENT.

PROVINCETOWN, MASS., Dec. 1, 1896.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—As superintendent of the province lands I respectfully submit the following report for the year ending November 30, 1896.

The work upon the province lands has been carried forward on about the same lines as in 1895. As the work of that year proved very satisfactory and seemed to accomplish the desired ends, it was deemed wise to continue it on the same lines as the best that could be adopted for the accomplishment of the work desired.

About the middle of April we again commenced the work of beach-grass planting and continued it from the point where it was suspended in the fall of 1895, and extended it along the slope toward "Nigger Head" about 1,000 feet, covering about 8 acres, continuing the work until May 17, when this line of work was suspended until September 28, when it was resumed and another section of about 8 acres was covered, making in all, this season, about 16 acres, and extending along the slope about 1,700 feet; covering in all since the work began, in the spring of 1895, an area of about 29 acres and a distance along the slope of about 4,600 feet. The condition of this work up to the present time is very satisfactory, although planted along one of the most exposed slopes within the lands. The work of 1895 withstood the severe northwest gales of last winter without showing a single break or the least drifting of

* See Appendix E.

sand in the whole area covered, and there is no reason to doubt that the work of the season of 1896 will prove equally satisfactory.

Besides beach-grassing we have covered with brush a considerable area along the top and southern slope of the same range where the beach-grass is sparsely growing, to prevent any further movement of the sands there, and this will allow the grass to spread from that already growing there and eventually cover the whole area without the necessity of transplanting. As we have said in former reports the main point to be gained in the work of reclaiming these lands is holding the sands in place, and there has been no better method devised or suggested than the one adopted and followed for the past two seasons. As in 1895, we have during the past season in addition to the beach-grass planting and brushing, transplanted from the nursery a large quantity of trees and shrubs along the foot of the slope mentioned, viz.: about 1,500 young pines, about 10,000 Scotch broom and about 5,000 other young trees and shrubs divided about equally among locust, white birch, alder, tamarix, ailanthus and hornbeam; have also put out about 5,000 silver poplars which were collected in this vicinity. Of these varieties all are doing well and showing satisfactory results, except the ailanthus and hornbeam, which, I think, will be of little value for this work.

The results of the Scotch broom planting this season have been very good, although the experiment tried with this shrub the first year proved an entire failure, owing to the very unfavorable conditions. The first experiment was made in the barren sands, and the drifting sands killed it at once. This year the planting was among the recently planted beach grass, where the sands remain still, and as a result 75 per cent. of the plants survived the transplanting and made quite a vigorous growth, and are now showing finely. This shrub now gives promise of being one of considerable value for the work; its value will be fully tested during another season.

The silver poplars and pines of the planting of 1895, as well as those of this season, are in a flourishing condition and seem to give evidence of being the most valuable for the purpose desired. I have received during the season about 5,000 tamarix, 1,000 of which we planted directly in the vicinity of the beach-grass work, and the other 4,000 put into the nursery, good results having been obtained in both cases. We are of the opinion that this shrub also may be used very profitably.

In addition to the tree and shrub planting, we have, during the season, made use of considerable quantities of seed, particularly of pine seed, which has been planted in different spots among the

beach grass, rather as an experiment. The seed germinated quickly, and judging from the present appearances of the young plants very gratifying results may be expected from this method of work. If successful, the area can be covered with tree growth much quicker than if we have to depend entirely upon nursery stock for transplanting.

We have continued the work upon the nursery and enlarged it considerably, and have now growing therein about 200,000 young plants, mostly pines of one and two years' growth, many of which will be available for transplanting another year.

We have extended the road in the direction of the Race Point Life Saving Station as far as Grand View Hill, a distance of about 650 feet, and it has been much travelled during the past season by persons from all sections of the State, to many of whom this possession of the Commonwealth is a revelation. We have also made repairs upon the other roads leading through the province lands sufficient to make them safe and convenient for public travel.

The season has been generally favorable for the work that has been carried on, although in the early part the drought interfered somewhat with the work of transplanting, but later the general conditions of weather changed for the better and worked much in our favor.

Of the appropriation for 1896 about \$500 has been expended in road building and repairing, and the balance in the work of tree planting, nursery work, beach-grass planting and brushing, and for other necessary expenses.

We would recommend the continuation of the work on the lines followed for the past two seasons. A much larger appropriation could be used profitably each year, and the time required to accomplish all that is desired upon these lands will depend largely upon the amount appropriated each year.

Respectfully submitted,

JAMES A. SMALL,
Superintendent, Province Lands.

REPORT OF THE LANDSCAPE ENGINEER.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—In compliance with your request, I would respectfully submit the following as a result of my partial study of the Province Lands at Provincetown, Mass., regretting that circumstances have been such as to preclude a more thorough and complete examination of the territory in question.

Being informed of the wishes and policy of your Board as regards the immediate treatment of this area, which I understand to be primarily to arrest the drifting of the sand toward the town and harbor, I have endeavored to furnish such suggestions and information as to me seemed best adapted to speedily and economically accomplish that result. All authorities agree that the only effective means by which this can be done is by clothing with a vegetable growth all areas susceptible to the wind's action.

As to the kind of growth best adapted for this purpose, different opinions have long existed. Inquiry shows that many thousands of dollars have been expended in the past in planting beach-grass (*Ammophila arundinacea*), that the citizens of Provincetown for many years annually went through the form of electing a "Beach Grass Committee," that considerable legislation has been enacted and re-enacted with a view to stopping the drifting of the sand, but in spite of all, it continued its onward march. I do not wish, however, to be understood as condemning the planting of this grass, — on the contrary, I am convinced that the sand hills are much farther from the town now than they would be had this work been left undone; and, indeed, I believe that the sand might be kept in a condition of perpetual quietude by its use alone, but only by constant watchfulness and attention to breaks as soon as they occur, which could only result in a perpetual tax upon the Commonwealth, with insufficient resultant compensation.

A more permanent growth of woody plants, capable of withstanding the harsh salt winds, seemed to be a more rational solution of the problem. Experimental plantings proved the advisability of first covering the area to be treated with grass, and following it with the woody growth. This method, which has been adopted and faithfully pursued by your superintendent, shows satisfactory results, as is evidenced by the result of this year's work.

The complete reclamation of this entire area now only depends upon the amount of money appropriated for the work.

To the question of the ultimate uses to which these lands might be put, and their adaptability for such uses, as well as to whether or not they might be made a source of income to the Commonwealth, I have given some thought, and while I would not attempt, with the limited study which I have been able to make, to exhaust the possibilities which here exist, I am fully convinced that future generations will show a heretofore unexpressed gratitude to our fathers for so faithfully maintaining the State's ownership in these lands, which I believe, in time, is destined to prove one of our richest possessions.

Here the annoying problem of private ownership has not to be met, the Commonwealth now being in undisputed possession of these thousands of acres of the grandest and fairest scenery in all our broad land, with many miles of open ocean shores, always free for all who wish to use it, your Board being in the unusual position of being able to begin operations without the customary embarrassment of requiring large appropriations for the acquirement of title.

Each succeeding year shows an increasing interest in these lands, not only by the people of this Commonwealth, but by those living in other sections of the country as well.

Here we find three thousand or more acres of sand, not level and uninteresting, but attractive in the extreme — a most happy combination of the “beautiful,” “picturesque” and “rolling;” high hills, some sloping gracefully from base to summit, others steep and cliff-like, some terminating in level plateaux, others in sharp ridges; all giving evidence of having been “lashed and torn by the storms of ages,” and suggesting thoughts of energy, power and violence; yet amidst all this turmoil of wildly drifting sand dunes may be found quiet, deep vales, which bring thoughts of rest and peace; broad meadows, the home of the “shore bird,” stretching out on either hand, clothed in places with tall, wavy grasses, and brightly tinted here and there with the rich colorings of the cranberry, salicornia and other examples of “Nature’s glory.” Here, also, may be seen bodies of pure crystal water, where the pond lily grows to a high state of perfection, and where other aquatic, sub-aquatic and bog plants find a congenial home. Large areas covered by a surprisingly luxuriant growth of trees, shrubs, and vines, and an almost innumerable number of herbaceous plants, as well as representatives of many families of annuals, meet the eye at every turn.

Nowhere has it been my privilege to witness so truly magnificent a growth of wild roses as we here find. They appear to spring spontaneously from the ground all through the wooded area. The depth of coloring found in their flowers, and the prolific production of fruit, together with the healthy vigor of their growth, is evidence, without cost of experiment, that other members of this numerous and interesting family may be added to the greater glory of the whole.

It would be difficult to find an equally extensive area, where the growth is so diversified and attractively luxuriant.

Here may be found the oak, beech, birch, maple, hornbeam and other native hard woods of our inland hills, working in perfect harmony with seashore plants, salt marsh and beach grasses, and other marine growths.

Many will be surprised to learn that the beautiful American heather (*Calluna vulgaris*) grows freely here, not in small patches, or isolated specimens, but acres and acres are here carpeted with this interesting plant in its best form and color; here, also, the growth of the bearberry (*Arctostaphylos Uva-ursi*), a plant now extensively used by our leading landscape architects as a "ground cover" in ornamental plantings, is well worth going many miles to see.

Our experimental work shows that many introduced European species of trees and plants readily adapt themselves to the conditions here existing. Among them may be mentioned the Scotch broom (*Genista scoparia*), French tamarisk (*Tamarix gallica*), European birch (*Betula alba*), Scotch and Austrian pine (*Pinus sylvestris* and *Austriaca*), and the seaside pine (*Pinus pinaster*, or *maritima*). This latter variety will prove most valuable in the solution of this problem, as is evidenced by what has been accomplished by its use in foreign countries, where by its use thousands of acres of communal forests have taken the place of an equal area of drifting sand desert, and are now paying a liberal revenue to the planters.

No doubt many other species will be found, as the work progresses, equally attractive and as well adapted to serve your purpose as those mentioned.

For the propagation and growing of the necessary planting material, the nursery which you have established there will continue to prove, as it has thus far done, a desirable and necessary adjunct. While much of the desired forest covering can best be produced by direct seeding, it is also true that many species required for the accomplishment of the desired result must of necessity be grown from cuttings; I therefore think you will find it advisable to continue this branch of the work.

I am pleased to say that the result of the nursery work this year has exceeded my expectations; the nature of the soil is such that, with your thoroughly effective, yet inexpensive, system of surface irrigation, combined with the faithful attention of your superintendent, the quality of stock produced is equal to the very best.

With all the existing conditions and facilities at your command, it becomes only a question of time when these lands can be completely reforested, thus not only removing all danger to the town and harbor from the drifting of the sand, but you will also have added materially to the value of this possession of the Commonwealth. It may then be maintained and treated as a forest reservation, which by judicious management, will become a source of revenue to the State by the sale of its products. In this same

connection, it might be stocked with game, which may be easily protected, owing to the fact that it is principally surrounded by water, and a considerable revenue would follow a sale of shooting licenses. The value of this feature might be materially enhanced by planting game cover and food-producing plants; the cost of such plants would probably not be more than of those with which you would naturally bind the sand. I would recommend the immediate planting of the shores and shallow borders of the fresh-water ponds with wild rice, and think it would soon be followed by an influx of mallard, black and wood duck, as well as other water fowl.

These lands might also be made into a park, as has often been suggested by others, but the conditions which here exist for its development into a most unique, beautiful and available park, for the enjoyment of all, are so favorable and the scope of this question is so great, that I do not deem it advisable to here discuss this feature. But whether or not these lands are to be devoted to either of the uses mentioned, the same method of operation which now obtains should be followed for at least a number of years; for any purpose, practically all of the "outside area" should be returned to forest growth. It would, however, be advisable to prepare specific planting plans, in order that any possible errors may be avoided. In order to prosecute this intelligently, a close topographical survey of the area to be treated should first be made, and herein your department is well equipped for this work, as you already have an organized party of engineers, with every facility at hand in your office.

I would urgently recommend that measures be taken at once to exclude the tide water from the "Race Run," which might be accomplished at small expense. If this is done, several hundred acres which are now intermittently covered by salt water would soon become a broad and beautiful fresh meadow, which would readily yield to the process of reclamation, and might in a few years be covered with a desirable growth. This area, which would thus become especially adapted for the purpose, might be planted with asparagus, and ought to result in large profit to the State.

Again, it would be well adapted, I believe, to the growing of the basket osier (*Salix viminalis*), which is imported from foreign countries to the extent of thousands of dollars' worth every year. I have been informed by our basket and furniture manufacturers that they prefer the best quality of native grown to the imported stock. To reach the highest degree in quality, it should be grown on "sandy bottom land," which we have here in abundance. By doing this, we not only utilize this waste and unproductive land,

but the growing, cutting, and preparing of this product would furnish labor to many of our people. It should be grown for three years before cutting; after this period it produces an annual gross income of from \$150 to \$200 per acre, according to the experience of those commercially engaged in growing it elsewhere.

In addition to these facts mention should be made of the very favorable sanitary and climatic conditions which here exist, and which make this locality an ideal one in which to reside for at least a portion of the year; and I am inclined to the belief that at no very distant day we shall see a most prosperous community occupying the now naked shores of Cape Cod, which will naturally require that this area be given more thought, and, in fact, result in its being devoted to public park purposes.

Respectfully submitted,

LEONARD W. ROSS,
Landscape Engineer.

BACK BAY LANDS.

Upon petitions of the owners of certain lots on the north-erly side of Boylston Street, between Arlington and Berkeley streets, in the city of Boston, the Board, believing that the objects for which the restrictions were originally inserted had been fulfilled, upon the receipt of adequate consideration, gave releases from the restriction in deeds from the Commonwealth of these lots prohibiting the use of the land for mercantile purposes.

CLAIM OF THE FISK HEIRS.

The suit begun by the Fisk heirs against the Commonwealth, under the provisions of chapter 49 of the Resolves of 1895, was finally adjusted to the satisfaction of all parties interested, and a decree* entered defining the boundary between the flats of the Fisk heirs and others and the flats of the Commonwealth, thus terminating a question of great doubt and uncertainty, owing to the destruction of ancient landmarks, on a just and equitable basis.

WRECKS.

On Aug. 12, 1896, the harbor master of Boston reported that the hull of an old wreck was floating about in Chelsea Creek, and was a danger to navigation. Upon investigation

* See Appendix F.

it was found to be the hull of the schooner "Mary C.," of St. John, N. B., which, last spring, was wrecked on Lynn Beach, while bound to Boston. She was hauled off and towed to Chelsea Creek and her cargo of lumber discharged; the hull was then placed on the flats in the creek, from which place it was floated by a high tide. The Commissioners were unable to learn who owned her, and as they considered her an obstruction to navigation, advertised for bids for her removal, and on Aug. 18, 1896, contracted* with W. H. Wyman, the lowest bidder, to break her up and deposit the materials on the shore above high-water mark, for the sum of \$210. The work was completed Sept. 14, 1896, the materials being placed on the Commonwealth's filled land at South Boston, from which place it was taken for firewood by people living in that section. The Board has given permits to parties having old timber and wood to dispose of to place it on the Commonwealth's property, from which it is quickly taken by poor people for firewood, without expense other than the labor necessary to break it up and carry it home.

On Sept. 9, 1896, the fishing schooner "Little Katy," of Boston, went ashore on White flats in Plymouth harbor. She was advertised for sale at auction by Herbert Morissey of Plymouth (per order underwriter), and was sold on Sept 30, 1896.

Upon inquiry the Board learned that the Boston Marine Insurance Company insured the vessel and, according to the statement of Mr. Morissey, ordered her sale. Oct. 2, 1896, the Board notified the Boston Marine Insurance Company to remove the wreck before Oct. 21, 1896. The insurance company replied that it had paid a total loss under its policies in full and had exercised no acts of ownership over the vessel and had nothing to do with the matter except to pay the loss. The Board has the matter under consideration.

On Oct. 28, 1896, notice was received from the office of the collector of customs at Salem that a sunken hulk had been deposited about 500 yards north of Aqua Vitæ ledge in Salem harbor, where she was an obstruction to navigation.

* See Appendix G.

The notice further stated that the wreck was the barge "Wilkesbarre No. 2," which was towed to its present position by steamer "Henry Preston, Sr.," Robinson, master. Captain Robinson, as requested, called at the office of the Board in company with Capt. Colcord Upton, who had contracted with the owners to remove the hulk from Phillips wharf and place it on the outer beach of Baker's Island, and who had employed Captain Robinson to do the towing for him. After discussing the matter, Captains Upton and Robinson agreed to remove the wreck and place her in a position where she would not be an obstruction to navigation, on or before Nov. 15, 1896. This wreck has been disposed of to the satisfaction of the Board.

The work of breaking up and removing the wreck of the steamship "Venetian" has progressed steadily during the year under the contract with Mr. Geo. W. Townsend. It was found to be impracticable to employ enough men advantageously to complete the removal before Dec. 1, 1896, as provided in the contract, and the time has been extended to Oct. 31, 1897, at which time it will undoubtedly be fully completed.

CONNECTICUT RIVER.

The general care and supervision of the Connecticut River and its banks were committed to this Board by chapter 344 of the Acts of 1885. Various sections of the river lying between North Hatfield and the Connecticut line have from time to time been brought to the attention of the Board and of the Legislature since 1885 by petitions for the erection of structures on the river and for the protection of the banks where they were worn by the waves and the current.

In 1888-89 appropriations were made for protecting the bank at the upper end of the village of Hadley, where the river threatened to break through and destroy the village. The execution of the protective work was carried out under the direction of the Board and was very successful; but at some time in the future it will undoubtedly have to be extended a short distance farther up the river in order to preserve the benefit already realized and to prevent the river cutting in back of the protective work. It was not deemed advisable at that time to extend the work, as the

danger was not immediate, and the construction would probably cost no more at some future time.

In 1891 appropriation was made by the Legislature for doing similar work at West Springfield. This also was executed under the direction of the Board and has completely remedied the defect.

In 1894–95 appropriations were made for protecting the bank in the town of Agawam where the river threatened to wash out the highway running along the bank. This work was carried out also under the direction of the Board and appears to be entirely successful as far as it extends. In its last report the Board estimated that it would take about \$3,000 to extend the work so as to protect the whole of this section of the bank. An appropriation of \$1,500 was made by chapter 95 of the Resolves of 1896, for extending the work from where it was left last year, and with this sum the Board has extended it so that the worst places have been protected. The appropriation was exhausted before the work as laid out was completed. The final item was paid by the town of Agawam, which donated the sum of \$69.95 for the purpose. There still remain in this stretch of about two miles of river places where the expenditure of a small sum of money now in planting willows and seed may prevent the river from undermining the bank and making breaches which in the future will require much larger sums to repair. The details of the protective work as extended this year will be found in the report of Messrs. E. C. and E. E. Davis, civil engineers in charge, to the Board.

In connection with this protective work and with studies for locating a river line at Springfield, which was established by chapter 301 of the Acts of 1893, surveys of portions of the river have been made, but up to last year nothing had been done towards the general survey provided for by chapter 344 of the Acts of 1885. By chapter 77 of the Resolves of 1896, \$1,000 was appropriated for beginning these surveys. This was done on the recommendation of this Board in its last annual report, suggesting that it was a work which could be carried on advantageously by small appropriations made from year to year, and that the present was a favorable time to begin the work. The town bound-

ary survey of the Topographical Survey Commission is now being prosecuted in that vicinity, and the triangulation stations and signals erected upon them formed the best basis which could be used for the survey, and by using these a great saving could be made in the cost of the work. The work was started in July and was continued through August, a triangulation being completed from a point just below the great bend at Hadley north nearly to the northerly line of the town of Hatfield. The map was extended from the southerly limit of the triangulation work about five miles up the river, when the field party was taken away to do some pressing work in connection with the dredging in Boston harbor. It was expected that the party could return and complete the first sheet of the survey in the fall; but, owing to the demands of other work in the office, this became impossible, and as it is not deemed advisable to employ new hands to complete the work on this sheet this year, it will have to lay over until the spring. The design of this survey is to place in the records of the county, and of the Commonwealth, an accurate plan of the river, which shall thereafter be the basis for determining the exact amount of the changes which are taking place, and be used as the groundwork in all future studies of the river. The work of the Topographical Commission is on too small a scale to be used for this purpose; but after this survey is made and recorded, it will not be necessary for it in any future maps of the vicinity to make field surveys, as reductions from this survey will be equal to the best work which would be required for its maps. As a result of this season's work, it is apparent to this Commission that it is advisable to continue the survey from year to year, to cover at least the portion of the river where active changes in the banks are now taking place. The mapping of the portion where great changes are not taking place does not seem to be of so much importance at the present time. It is estimated that another appropriation of \$1,000 (being the same sum appropriated last year) can be profitably expended the coming season, and it is expected that this will enable the Board to complete the map of the river (including the work done the present season) for a distance of from 12 to 15 miles.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., Chairman.

GENTLEMEN : — We herewith submit our report of work done the past season on the extension of the protective works, commenced in 1894, on the Connecticut River bank in the town of Agawam, under the provisions of chapter 95 of the Resolves of 1896.

The work, as directed by your Board, has been done under the same general plan and methods as in previous years and extended down the river for a distance of 436 feet, from the point where it was suspended one year ago, to the line of the Calla Shasta property, where the highway diverges from the bank of the river. This, you will note, is 16 feet more in length than recommended in our report of 1895, as it was found, upon making surveys, that the southerly line of the land taken for highway purposes was that distance farther down the river than the line indicated by the existing fence marking the supposed northerly boundary of the Calla Shasta property.

The completion of this reach forms a continuous line of protective works for the highway and adjoining property, 2,028 feet in length up and down the river, and its effect on the general character of the river bed is noticed in the disappearance of several sand bars that were forming at different points in the river against the works previous to 1894, and also in the average increased depth of water in the easterly half of the width of the river and a corresponding shoaling in the westerly half, with the exception of one line, as indicated by comparisons made with the soundings taken across the river on different lines in 1894, before this work was commenced, and again on the same lines this season, all being referred to the same height for the surface of the water in the river.

The accompanying cross-sections * of the river bed show these changes, No. 37 being at the extreme upper end of this reach of the work and No. 48 being 200 feet below the lower end of this season's work.

The exception above referred to is at No. 45, which is 100 feet below the highway culvert and near the point where the river broke through the new highway embankment in the freshet of January, 1896. We attribute the abrupt deepening of the channel near the westerly bank of the river at this point to the back rush of water from the meadows on the westerly side of the highway, through this washout, caused by the rapid fall in the river after it had reached its maximum height in this freshet.

* Not printed.

The number of square yards of surface covered by mats and stone riprapping on this part of the work the past season is 1,721, at a total cost of \$1,222.98, or 71 cents per square yard. The remainder of the appropriation, \$277.02, has been expended on the river bank commencing at a point about 7,175 feet above the upper terminus of the work done in 1895, and immediately below the homestead of James Green, and extending 130 feet in length down the river, covering 520 square yards of surface, at a cost of 66 cents per square yard.

The amount of the appropriation left unexpended not being sufficient to finish this section of the river bank that had been graded and fitted to receive the mats and riprap work, the town of Agawam assumed the additional cost, amounting to \$69.95, and the work was completed as far as any break has been made in the bank by grading or other work.

The contract for furnishing the stone for the season's work was awarded to Fred P. Stanton of Huntington, Mass., for \$1.78 per cubic yard, delivered at the river bank. 204.2125 yards of stone have been used, and the quality of stone and delivery have been satisfactory.

The remainder of the tract of willows bought of John D. Colton, 2d, in 1895, and not used that year, has been used in the past season's work, and the balance needed was bought of David Booth of Longmeadow and C. L. Campbell of Agawam at a cost of \$21.75.

Work was commenced August 3 and closed September 30, local help being employed under the supervision of W. C. Campbell, who has been employed in that capacity since the work was first begun.

We recommend that the work below the James Green homestead be continued next season down the river to a point where the present growth of willows, etc., forms a sufficient protection to the bank from farther encroachments of the river.

There are also places on the bank opposite the house of S. Clark where the expenditure of a few dollars at the present time on weak places would be good economy on the part of the State.

Respectfully submitted,

E. C. AND E. E. DAVIS,
Engineers.

NORTHAMPTON, MASS., Nov. 2, 1896.

In November, William H. Niles, Professor of Geology at the Massachusetts Institute of Technology, at the invitation of the Board, accompanied its engineer in an examina-

tion of the Connecticut River, at those points especially at which the recent appropriation of the Legislature had been expended. A letter received from him by the Board, relative to his observations, is both interesting and instructive, and is as follows : —

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
BOSTON, Jan. 22, 1897.

WOODWARD EMERY, Esq., *Chairman of Harbor and Land Commissioners.*

SIR : — I have the honor of submitting to you a report upon some observations made in company with Mr. F. W. Hodgdon, relative to the destructive agency of the Connecticut River at certain localities in Massachusetts.

An examination was made of the right bank of the river below Springfield, including the portions which have been protected in the town of Agawam.

An unusually straight reach of the river extends from the bend indicated on the map * by the letter A,† to the slighter bend beginning at B.‡ The river here has more than its average width, the current is relatively slow and its greatest movement is some distance from the right bank. At B, where the last protective work has just been completed, the river begins to curve to the left, and consequently the right bank there and along the bend is more exposed to the action of the current. But the wearing of the bank between A and B requires some further explanation.

I agree with Mr. Hodgdon in the opinion which he has formed that the wear of this portion of the bank is due more to the action of the waves than to the influence of the current. Quite an extent of the river is here exposed to the sweep of the southerly winds, which naturally produce considerable wave action. At the locality where the last protective construction has been completed the river begins to curve toward the left, and consequently the right bank here, and for some distance below, is more exposed to the action of the current. I believe that the character of the bank itself at this place is an evidence of such action.

But, above this point, where the river threatens encroachment upon this bank, and even upon the highway, another fact is worthy of consideration. The soil is very fine in texture, and where not held in place by growth of vegetation, it is very easily denuded by running water. If the soil had the same cohesion that may be observed in some other portions of the river banks, the erosion would be less. The cause of the fineness of the material consti-

* Not printed. † The point A is directly opposite the mouth of Pecowsic Brook.

‡ The point B is at the northerly end of the Calla Shasta camp ground, in Agawam

tuting the bank at this particular place is a topic which possesses some interest.

The loose materials which occur in the valley are naturally classified in three groups which may be described in the order of their age. The first group of unconsolidated materials includes those which were deposited by glacial action. To this group belong the erratic boulders and pebbles often associated with coarse gravel, but always unstratified, and which form in places quite irregular mounds, hillocks and ridges. The group also includes the stony clays, likewise unstratified, and which constitute at some localities the most veritable hard-pan of the valley.

In the second group we have those stratified sands and gravels, which in some places form plains considerably elevated above the level of the river, and which are often of considerable extent. In this same group are certain stratified clays which are commonly known as brick-clays. The stratified structure presented by the materials of this second group shows that they have been deposited by water and not by ice. At many places these deposits lie upon or over those of the first group, and this position proves their later age.

The third group includes the soils which constitute the actual surface of the ground. At many places in the valley these soils are simply fine sediments which have been deposited from the waters which in flood seasons overflow some of the lower grounds, and they have consequently been called alluvial soils. These vary considerably in fertility at different localities, but they are always fine and usually quite loosely aggregated. The right bank of the river, at the locality under discussion, and represented upon the map between A and B, is composed of this third group of materials, and it is, therefore, easily worn or carried away by the action of running waters unless protected by vegetation. In examining this portion of the river bank it was readily observed that wherever a road or pathway had killed or removed the vegetation which had grown upon its surface, the weather and the waters acted most readily in channelling and removing the soil. At some other places it was very evident that the natural growth of vegetation is serving an important purpose as a protective agent.

I was glad to observe that at a few of these places your Board has taken active steps to prevent the beginning of denudation at points where the continuity of the vegetation had been broken. I would recommend that this bank be frequently visited for the purpose of ascertaining if the surface has been deprived of its protecting vegetation by the formation of pathways, by boat landings,

or by other means. I would also recommend that, as far as practicable, measures be taken to prevent more pathways being formed by domestic animals or human beings than are essential, and when they are needed that protection be given by the use of stones or other firm substances. I would further recommend measures to promote plant growth, which may be easily accomplished by the use of willows. It seems to me that the protection of this portion of the bank need not be an expensive one, but that some degree of caution is needed to prevent the beginnings of wearing action. As the waves, to which reference has been made, are features of the surface of the water, and as the river current has but little influence, excepting at times of flood, it seems to me that the danger of undermining the banks below the average level of the river surface is not very great.

Another locality which we examined is in the town of Hadley, south of the village and on the left bank of the river, at the place indicated on the map by the letter C.* The river here turns quite abruptly from an easterly to a southerly course. At the bend the channel is narrow and the current has considerable energy. Just below the most abrupt portion of the bend there outcrops, from the lower portion of the bank, a bed of clay of the kind described as brick-clay. The top of the clay-bed was but little above the surface of the river at the time of our visit, a day when the water was higher than usual, but the river was not flooded. It was obvious that this clay-bed retarded the wearing of the bank by the river. We observed that the current, washing the edge of the clay, was continually carrying away exceedingly fine material in suspension, but the adhesive nature of the clay obstructed the usual process of undermining, and the bank was thereby measurably protected. Should it eventually be found desirable to give artificial protection to this bank, the clay at the bottom will be found very serviceable as a foundation upon which to place any construction that may be adopted.

Below this bend, at the locality indicated upon the map by the letter D †, the clay-bed did not appear. At this location the general surface is lower than at the bend. Only a portion of the river flows between Shepherd's Island and the left bank, but with a strong current which is apparently making quite an inroad upon the meadow. Judging from the laws of flowing streams and the yielding of their banks, I predict that the erosive power of the river here will increase rather than diminish, and I anticipate that it will not long be possible to maintain the highway in its present posi-

* The point C is about three-quarters of a mile north of Shepherd's Island.

† The point D is opposite Shepherd's Island.

tion. As the land here is not very valuable, and as the road can be easily moved to another location, it will perhaps not be regarded as essential that any work for the protection of the land be done here. As the bed of clay which occurs at C does not appear here, the erosion will be greater, although the bank is less exposed to the power of the current. The absence of the clay bank at this locality I explain as one of the results of ancient action, when the volume and the velocity of the stream were greater than at present.

I was also interested in the success of the efforts for the protection of the caving bank near the northern end of Hadley Street, marked E* upon the map. It is quite evident that this work must soon be extended farther up the stream. I was much pleased to see that the method adopted of sloping the bank, of placing stones and the planting of willows, has proved to be so effective. I think the work which has been done leads us to confidently expect that this important portion of Hadley, which is most exposed to the destructive energy of the river, may be protected by these comparatively inexpensive means.

I was very much interested in examining the bank of the river where it makes a very sudden turn near the two railways north of Northampton, at the place marked F† upon the map. There is no danger whatever of the river extending its curvature any farther in a westerly course. The occurrence of the hard, crystalline rock near this location, the existence of an old glacial moraine forming a resisting buttress on the southerly side of this curve, with an accumulation of clay filling the space between them, furnish a substantial natural protection. As the clay is being removed for the purpose of brick making, it may be advisable to watch the progress of the excavation or place some restriction upon it; but as it is at present, I do not see that there is any danger at this point.

Respectfully submitted,

WM. H. NILES.

CHARLES RIVER.

The work of the Charles River Embankment Company the past year has been confined to completing the filling of the streets on its property east of Massachusetts Avenue. The gravel for this work was taken from the flats of riparian owners near West Boston bridge, on the Cambridge side of the channel, outside the harbor line.

* The point E is on the left bank of the river, on the northerly side of Hadley village and between its two principal streets.

† The point F is at the extreme westerly part of the great bend opposite Hadley and about one-quarter mile above Elwell Island.

This work has not affected the tidal volume and has not directly improved the facilities for navigation, as the flats dredged are at a considerable distance from the existing channel; but it leaves just so much less to be removed at some future time, when the whole basin will undoubtedly be excavated to remove the unsightly flats.

A quantity of gravel from the flats of the Commonwealth, near the channel, was sold to Lyman Boynton, to be used in making the beach at the new North End Park of the city of Boston, at 15 cents per cubic yard, and the sum of \$500 has been collected and turned into the treasury.

Between West Boston and Craigie's bridges the work of filling on the Cambridge side of the river, which was described in our last report, has been continued during the year, but is still in an unfinished condition. Very little of the filling has been taken from the river, but is mostly composed of ashes and other refuse material brought in carts from Boston and Cambridge.

A short section of the river bank on the Cambridge side, above Boylston Street bridge, has been improved and a beach constructed by the Park Commissioners of the city of Cambridge, and it is expected that further improvements will be made in the near future.

MASSACHUSETTS MARITIME CANAL COMPANY.

On Aug. 17, 1896, a petition was received from the Massachusetts Maritime Canal Company, for the approval by the Joint Board of Railroad and Harbor and Land Commissioners, under chapter 542 of the Acts of 1896, of an issue of stock and bonds. After public notice and hearing, the following order was passed:—

IN BOARD OF RAILROAD COMMISSIONERS AND HARBOR AND LAND
COMMISSIONERS, SITTING AS A JOINT BOARD.

SEPTEMBER 29, 1896.

In the matter of the petition of the Massachusetts Maritime Canal Company for the approval by the said Joint Board, under chapters 542 of the Acts of 1896, and 462 of the Acts of 1894, of an issue of capital stock by said company to the amount of \$6,000,000, and also of an issue of bonds by said company to the amount of \$6,000,000, for the purpose of building and equipping

a ship canal, and of defraying the cost and expense incident thereto, as set forth in said petition, —

It appearing, after public notice and hearing, that said company has been chartered by said chapter 542 of the Acts of 1896 for the purpose of constructing and maintaining a ship canal extending from Buzzard's Bay to Cape Cod or Barnstable Bay, through the towns of Bourne and Sandwich, or either of them, with an authorized capital stock of \$6,000,000, and with authority also to issue bonds not to exceed its capital stock at the time actually paid in; and

It being deemed by the said Joint Board that an issue of capital stock and an issue of bonds by said company to an amount not to exceed \$6,000,000 each, to be issued from time to time, as hereinafter provided, may be reasonably requisite for the purposes for which such issues have been authorized as aforesaid; it is

Ordered, That the said Joint Board approve an issue by the said Massachusetts Maritime Canal Company, subject to the provisions of all general and special laws applicable to such issue, of not to exceed in the whole 60,000 shares of its capital stock, amounting at the par value thereof to \$6,000,000, and of not to exceed in the whole at the par value thereof \$6,000,000 of its bonds, payable at periods not exceeding fifty years from the date thereof, with interest at a rate not to exceed five per cent. per annum, and secured by a mortgage of its franchise, canal equipment, and all of its property, real and personal; the said stock and bonds, or the proceeds thereof, to be applied to the purposes set forth and specified in said chapter 542 of the Acts of 1896, and to no other purpose; and the issues of the said stock and bonds to be made in the manner and upon the terms and conditions following, and not otherwise: —

1. The capital stock of said company shall be duly subscribed; and said company shall be duly organized, and its corporate organization shall be duly maintained, as regards the choice of officers and otherwise, in the manner provided in the general laws of this Commonwealth relating to railroad corporations. It shall have its office and hold its meetings in this Commonwealth; and its books, records and contracts shall be submitted to said Joint Board, whenever requested by it, for examination.

2. No shares of stock or bonds shall be issued except upon payment of the par value thereof in cash, or in payment for labor performed and material furnished in construction, or in payment for property acquired, as authorized by said chapter 542 of the Acts of 1896.

3. All certificates of stock and all bonds of said company shall be certified and issued only by and through the New England Trust Company, of Boston, or some other Massachusetts trust company approved by said Joint Board, under an indenture of trust of which the terms and conditions have been also so approved; and the same trust company shall be made the trustee in the mortgage securing the bonds.

4. Upon the due authorization by votes of the stockholders of said canal company of issues of its capital stock and mortgage bonds to the amounts aforesaid, and upon the due execution and delivery of such indenture of trust and mortgage, said canal company may execute and deliver to such trust company its certificates of stock and mortgage bonds to an amount not exceeding at par \$6,000,000 each; but the said certificates of stock and bonds shall be certified and issued by such trust company only as follows:—

(1) Stock to the amount of \$100,000, and bonds to a like amount, shall be certified and issued to said canal company, or its order, as soon as a deposit of \$200,000 has been made by said canal company with the treasurer of the Commonwealth, in accordance with the provisions of section 23 of said chapter 542 of the Acts of 1896.

(2) Said trust company may certify and issue in like manner such further amounts of stock and bonds, not to exceed in the aggregate (including the issues above mentioned) \$6,000,000 each, as from time to time, on the application of said canal company, shall have been approved and certified by said Joint Board, in the manner provided in chapter 462 of the Acts of 1894, as reasonably requisite to enable said canal company, promptly and in good faith, to carry out the purposes set forth and specified in said chapter 542 of the Acts of 1896: *provided*, that the total amount of bonds so approved, certified and issued shall at no time exceed the total amount of capital stock then actually paid in and outstanding as aforesaid.

JOHN E. SANFORD,
WILLIAM J. DALE, JR.,
GEO. W. BISHOP,
Railroad Commissioners.

WOODWARD EMERY,
CHAS. H. HOWLAND,
Harbor and Land Commissioners.

46 HARBOR AND LAND COMMISSIONERS. [Jan.

On November 13, 1896, the Joint Board, under chapter 222 of the Acts of 1887, executed the following order dismissing the petition of the Cape Cod Ship Canal Company, dated October 22, 1891 : —

IN BOARD OF HARBOR AND LAND COMMISSIONERS AND RAILROAD COMMISSIONERS, SITTING AS A JOINT BOARD.

NOVEMBER 13, 1896.

In the matter of the application of the Old Colony Railroad Company for the dismissal of a petition of the Cape Cod Ship Canal Company, —

It appearing, that said last-named company, on October 22, 1891, filed with said Joint Board a petition, under chapter 222 of the Acts of 1887, asking said Board to determine, *First*, the point or points at which, by alteration of the location of the Old Colony Railroad Company, it should cross the Cape Cod ship canal, and *Second*, the question whether said canal should be crossed by a public highway, and, if so, at what point and in what manner ;

And it also appearing that no final order has been passed, or decision made, on said petition by said Joint Board, and that for a long time no steps have been taken in behalf of the petitioner for the further prosecution thereof ; it is

Ordered, The counsel of record for the petitioner having been notified and making no objection thereto, that the said petition be dismissed for want of prosecution.

WOODWARD EMERY,
CHAS. H. HOWLAND,
Harbor and Land Commissioners.

JOHN E. SANFORD,
GEO. W. BISHOP,
Railroad Commissioners.

WORK OF THE UNITED STATES IN RIVERS AND HARBORS OF THE COMMONWEALTH.

The following statements, made by Lieut.-Col. Samuel M. Mansfield, Corps of Engineers, U. S. A., who is in charge of river and harbor improvements in eastern Massachusetts, and by Maj. D. W. Lockwood, Corps of Engineers, U. S. A., who is in charge of similar improvements in southern Massachusetts, show the work accomplished by the United States government in the rivers and harbors of this Commonwealth during the year : —

STATEMENT OF LIEUT.-COL. S. M. MANSFIELD, CORPS OF ENGINEERS, U. S. A.

DEC. 31, 1896.

*The Harbor and Land Commissioners, Commonwealth of Massachusetts,
Boston, Mass.*

GENTLEMEN:—In accordance with your request of the 15th inst., I have the honor to furnish the following summary of the work done by the United States during the year 1896, in those rivers and harbors of Massachusetts which are under my charge:—

1. Newburyport Harbor.

The project for the improvement of the harbor has not been changed. No work was done during the year. The river and harbor act of June 3, 1896, appropriated \$16,000 for this harbor; and this sum will be expended in extending the south jetty, under a contract now in force with the Rockport, the Pigeon Hill and the Cape Ann granite companies. Operations will be commenced under this contract early next year. No survey of the bar was made during the year.

2. Harbor of Refuge, Sandy Bay.

The project remains unchanged.

During the year operations were continued under the contract with the Cape Ann Granite Company, and 115,000 tons of rubble-stone were deposited in the substructure of the breakwater.

The act of June 3, 1896, appropriated \$150,000 for this improvement; and this sum will be expended in continuing the building of the substructure of the breakwater, under a contract now in force with the Rockport, the Pigeon Hill and the Cape Ann granite companies. One thousand five hundred tons of rubble-stone were deposited in the breakwater during the year, under this contract.

3. Gloucester Harbor.

No change in the project has been made.

The contract with the Rockport Granite Company was completed during the year. Under it 56,800 tons of rubble stone were deposited in the substructure of the breakwater from Eastern Point, completing about 500 running feet.

The act of June 3, 1896, appropriated \$34,000 for this harbor, of which \$2,000 may, in the discretion of the Secretary of War, be expended in removing a pinnacle rock in the outer harbor, a rock called "Elisha's Rock" in the inner harbor, and a rock near the ferry landing at Rock's Neck in the inner harbor. These rocks

have been surveyed and a project for their removal will be submitted soon. The remaining \$32,000 will be expended in the extension of the Eastern Point breakwater, under the contract now in force with the Rockport, the Pigeon Hill and the Cape Ann granite companies. Under this contract 1,500 tons of rubble-stone were deposited during the year.

4. *Manchester Harbor.*

The act of June 3, 1896, directed the Secretary of War, out of the appropriation on hand, to cause a survey and estimate of cost of improvement to be made with a view of straightening the channel between the mouth of Manchester Harbor and Proctor's Point, removing obstructions at the mouth of the channel and at the point of rocks, dredging the channel for its entire length between its mouth and the town wharf to a width of from 200 feet narrowing to 150 feet and a depth of 8 feet, and providing turning basins and anchorage for boats by the dredging of the flats for that purpose. This survey has been made, and a project will be submitted early next year.

5. *Lynn Harbor.*

No change has been made in the project.

The act of June 3, 1896, appropriated \$20,000; but a project for its expenditure awaits the study of an examination of the channel recently made.

6. *Boston Harbor.*

No change has been made in the project for its improvement. Operations were conducted during the entire year under the contract of Messrs. Townsend & Johnston for the removal of the ledges uncovered by the dredging done in the main ship channel. Under this contract 3,821 cubic yards of ledge have been removed. The contract has been extended to June 30, 1897.

The act of June 3, 1896, appropriated \$70,000 for this harbor, as follows:—

Improving harbor at Boston, Massachusetts. Continuing improvement, \$70,000: *provided*, that this sum may, in the discretion of the Secretary of War, be used in the preservation and improvement of said harbor, including the project for improving the main ship channel, and that \$7,000 of this sum may, in the discretion of the Secretary of War, be used in improving Chelsea Creek, and so much thereof as the Secretary of War, in his discretion, shall direct to be expended for the protection of Great Head, Winthrop, to prevent the further washing away by the action of

the sea: *provided*, that contracts may be entered into by the Secretary of War for such materials and work as may be necessary to carry out the revised project of August 11, 1892, such contracts to provide that said ship channel shall be widened to a minimum width of 1,000 feet and a minimum depth of 27 feet, to be paid for as appropriations may from time to time be made by law, in the aggregate not to exceed \$1,145,000, exclusive of amount herein and heretofore appropriated.

The \$7,000 allotted for Chelsea Creek has been expended under a contract with the Eastern Dredging Company. The improved channel is at least 20 feet wide and 4 feet deep at mean low water to the head of navigation.

The Secretary of War has decided to expend no part of this appropriation for the protection of Great Head, Winthrop, and the balance of \$63,000 on hand will suffice to supervise the continuing contract for the improvement of the main ship channel, should satisfactory prices be obtained under the call for proposals dated Dec. 16, 1896.

7. Scituate Harbor.

No active operations were in progress during the year.

The \$6,000 appropriated by the act of June 3, 1896, will be expended under a contract now in force with the Eastern Dredging Company in deepening the entrance channel to 7 feet at mean low water.

8. Plymouth Harbor.

No change during the year.

9. Wellfleet Harbor.

No change during the year.

10. Provincetown Harbor.

The several works of preservation on the beaches remain essentially the same as at the close of last year.

11. Chatham Harbor.

No change during the year.

12. Merrimac River.

The act of June 3, 1896, provides for the improvement of the channel of the Merrimac River, by removing certain rocks therein below Rocks bridge, \$5,000.

The Secretary of War is directed to furnish to the House of Representatives an estimate of the cost of improving the Merrimac River, by dredging the channel thereof between Newburyport and Haverhill of the width of 150 feet and of the depth of 7 feet at mean low water, provided the estimate can be furnished from surveys already made.

A detailed survey of the rocks was made during the resurvey of the river ordered by the river and harbor act of 1894. A contract was entered into with the Eastern Dredging Company to remove these rocks and the work has been accomplished, leaving the improved channel at this locality 150 feet wide and 12 feet deep at ordinary high water in the river.

13. Powow River.

Operations were continued during the working season under the contract with Mr. Augustus R. Wright, and the channel made 30 feet wide and 12 feet deep at mean high water.

The act of 1896 appropriated \$5,000 for continuing this improvement, and it will be expended under a contract now in force with the Eastern Dredging Company in widening a portion of the channel to 45 feet.

14. Essex River.

No work has been done in this river during the year. Five thousand dollars was appropriated by the act of June 3, 1896, but it is likely that its expenditure would produce no appreciable benefit to commerce.

15. Mystic and Malden Rivers.

No operations were in progress during the year. The \$10,000 appropriated by the act of June 3, 1896, will be expended under a contract now in force with Mr. Augustus B. Martin.

16. Town River.

It is proposed to improve this river by dredging a channel 4,500 feet long, 100 feet wide and 4 feet deep at mean low water to the head of navigation. The appropriation of \$10,000 made by the act of 1896 will be expended under a contract now in force with Messrs. Perkins & White, by which it is expected the channel will be made of full length and depth, 50 feet wide.

17. Weymouth River.

The project for Weymouth Fore River has not been changed and no work was done on it during the year. The funds made available for this improvement by the act of June 3, 1896, will be

expended under a contract now in force with Mr. Augustus B. Martin, in making the channel 60 feet wide to Braintree bridge and completing the project above the bridge.

In Weymouth Back River it is proposed to dredge a channel 200 feet wide and 12 feet deep to the Fertilizer Company's wharf.

18. Wrecks.

The wreck of the schooner "Lillie" was removed from Broad Sound, Boston harbor, under a contract with Messrs. Duncan & Nickerson.

19. Examinations and Surveys.

The act of June 3, 1896, provided for surveys and projects for the improvement of the following:—

Merrimac River from Lowell to New Hampshire State line.

Marblehead harbor, with a view of improving the harbor by building a sea wall to protect the isthmus connecting Marblehead Neck with the town of Marblehead.

Provincetown harbor, with a view to erecting a dike for the protection of that harbor.

Neponset River.

Lynn harbor, with a view to securing a channel 300 feet wide and 15 feet deep at low water.

Boston harbor, with a view to securing a channel 1,200 feet wide and 30 feet deep from the navy yard to the entrance of the present main ship channel, and from the main ship channel in President Roads through Broad Sound channel.

Manchester harbor.

Plymouth harbor.

Weymouth Back River from Hingham bridge to Mann's wharf.

With the exception of the Merrimac River and Boston harbor, these surveys have been made and the notes are being plotted.

Preliminary examinations and reports at the following localities were also ordered:—

Gurnet Rock and other rocks at mouth of Plymouth harbor.

Duxbury Beach, with view to protection of harbor.

Duxbury harbor, with view to widening and deepening improvement.

The examinations have been made and reports will be submitted in due time.

Very respectfully,

S. M. MANSFIELD,
Lieut.-Col., Corps of Engineers.

STATEMENT OF MAJ. D. W. LOCKWOOD, CORPS OF ENGINEERS,
U. S. A.

Abstract of work of river and harbor improvements done in the State of Massachusetts by the United States government, under direction of Maj. D. W. Lockwood, Corps of Engineers, U. S. A., for the fiscal year ending June 30, 1896.

Taunton River.

The work under the contract with the Columbia Dredging Company, of Fall River, Mass., was completed. Three thousand nine hundred and forty-three cubic yards of sand, gravel, cobble stones and 1.6 cubic yards of bowlders were removed between Blake's wharf and North Dighton, completing the channel from the head of navigation to the mouth of Three Mile River.

Hyannis Harbor.

Nothing was done during the fiscal year. A contract was in force with the Hartford Dredging Company of Hartford, Conn., covering about \$2,000 worth of dredging, which was completed during the season.

Nantucket Harbor.

At the commencement of the fiscal year the work of constructing the east jetty was in progress under a contract with Humphrey Toomey of Guilford, Conn., covering about \$18,000 worth of stone placed in the jetty. The contractor placed 3,000 tons of core stone and 4,954 tons of facing stone during the year. The east jetty was extended 995 feet up to the level of 1.5 feet below mean low water, and the core and a portion of the facing laid for an additional distance of 210 feet, making the end of the stone work 4,840 feet from the shore.

Edgartown Harbor.

Nothing was done during the fiscal year. A contract was in force with the Hartford Dredging Company of Hartford, Conn., covering about \$1,200 worth of dredging, which was completed during the season.

Vineyard Haven Harbor.

Nothing was done during the fiscal year. It is proposed to continue work next season with such funds as may be available on the work of protection to the East and West chops.

Wareham Harbor.

No further work is at present proposed at this harbor.

Woods Holl Harbor.

At the last session of Congress an appropriation of \$20,000 was made for deepening and widening the channel connecting Woods Holl with Buzzards Bay. It is proposed to expend the available funds in commencing the enlargement of the channel to a width of 300 feet and a depth of 13 feet.

New Bedford Harbor.

Work of dredging in the main channel leading from Buzzards Bay to New Bedford was practically completed, 30,979 cubic yards of material was removed, making the channel 200 feet wide and 18 feet deep. During the next fiscal year it is proposed to commence the excavation of an anchorage area 18 feet deep adjoining the channel between New Bedford and Fairhaven.

Canapitsit Channel.

Nothing was done. A contract is in force with the Hartford Dredging Company of Hartford, Conn., covering about \$3,500 worth of dredging to be done next season.

Wrecks.

During the last fiscal year the following wrecks were removed so as to no longer obstruct navigation:—

Schooner "Robert Mowe," sunk in Hyannis harbor.

Schooner "Addie G. Bryant," sunk by collision in Pollock Rip Channel.

Schooner "Mary A. Heaton," wrecked and sunk about 2.25 miles south-east of Nausett Life-saving Station.

Schooner "Frank A. Magee," sunk by collision in Pollock Rip Slough.

Barge "Tivoli," wrecked and sunk about 3.5 miles N. E. by N. from Pollock Rip Light Ship.

Schooner "Wm. Wilson," sunk by collision midway between the Shovelful and Handkerchief light ships.

Unknown schooner, 4 masts, sunk one-half mile west of Pollock Rip Light Ship.

Schooner "Enterprise," sunk in Vineyard Sound one-eighth of a mile E. S. E. of buoy No. 11A, eastern end of Norton Shoal.

HANGMAN'S ISLAND.

The Board has leased to Wm. J. Greenfield and James E. Glassett, Hangman's Island in Boston harbor, for the term of three years from Jan. 1, 1896, at an annual rental of fifty dollars.

This island is situated within the tide-water limits of the city of Quincy, and is subject to the jurisdiction of that city, but, having no other ownership, belongs to the Commonwealth.

INSPECTIONS MADE DURING THE YEAR.

1896.

- | | | |
|-------|-----|--|
| Jan. | 13. | Site of proposed building over Charles River, in Watertown. |
| Jan. | 22. | Dinah's Pond, in Yarmouth. |
| Jan. | 25. | Site of proposed bridge in Red Brook harbor, in Bourne. |
| Feb. | 13. | Site of proposed dam at Wianno, in Barnstable. |
| Feb. | 14. | Encroachments upon Merrimac River, in Newburyport. |
| Feb. | 27. | Beach at North Scituate. Proposed removal of gravel. |
| March | 4. | Cooper's Pond, in Carver. |
| April | 4. | Green Harbor, in Marshfield, with legislative committee on Harbors and Public Lands. |
| April | 9. | Wharves of George Parker in East Boston, and site of proposed structure to be erected by J. D. W. French on Chelsea Creek, in Chelsea. |
| April | 22. | Wharf of Leonard Thompson, in Hingham. |
| April | 24. | Stillwater Pond, in Chatham. |
| May | 1. | Wharf of Nathaniel E. Harlow, in Plymouth. |
| May | 2. | Premises of Joel F. Sheppard on Weymouth Fore River, in Quincy. |
| May | 4. | Site of proposed wharf extension at Wing's Neck, in Buzzards Bay. |
| May | 5. | Premises of Amelia Swanson and Augusta De Wolf at Harbor View, in East Boston. |
| May | 6. | Site of proposed structures of the Pope's Island Manufacturing Corporation, in New Bedford harbor. |
| May | 7. | Fall River harbor. Dumping ground for dredged material. |
| May | 8. | Wharves of Melville E. Grey and Putnam & Pope, on Beverly Creek, in Beverly. |

- May 11. Beach at Hough's Neck, in Quincy. Proposed removal of gravel.
- May 13. Site of proposed wharf of town of Manchester, in Manchester harbor.
- May 14. Fall River harbor. Dumping ground for dredged material.
- May 22. Encroachments upon tide water, at Savin Hill.
- May 27. Peddocks Island, in Boston harbor. Proposed removal of gravel.
- May 28. Lamper's Mill Pond, in Lynn.
- June 1. Beach in Cohasset. Proposed removal of stones.
- June 10. Beach at Point Allerton, in Hull. Proposed removal of gravel.
- June 11. Beach at Green Hill, in Hull. Proposed removal of stones.
- June 15. Encroachments on Buzzards Bay, at Monument Beach.
- June 18. Wharf of J. F. Appleton, at Salem Willows.
- July 1. Encroachments upon Merrimac River, in Newburyport.
- July 11. Province Lands, in Provincetown.
- July 17. Structure in tide water, at Savin Hill.
- July 24. Beach at Point Allerton, in Hull. Proposed removal of gravel.
- July 25. Apple Island, in Boston harbor. Proposed removal of stones from flats.
- Aug. 8. Site of proposed wharf of G. J. Bicknell, in Hull.
- Aug. 10. Shiverick's Pond, and site of proposed wharf of the Vineyard Sound Wharf Company, in Falmouth.
- Aug. 13. Beach in Hull. Proposed removal of gravel.
- Aug. 14. Thompson's Island, in Boston harbor. Proposed removal of material.
- Sept. 12. Wharf and boat-landing of Alexander Duncan, at Savin Hill.
- Sept. 15. Summer street, in Lynn. Proposed widening in tide water.
- Sept. 18. Wharves of the New Bedford Yacht Club, and Garfield & Proctor Coal Company, in New Bedford harbor.
- Sept. 21. Site of cables across Merrimac River, in the city of Haverhill and towns of Bradford and Groveland.
- Sept. 29. Wharf of Boston Electric Light Company, and site of proposed structures of the Boston Terminal Company, on Fort Point Channel, in Boston.
- Oct. 1. Wharf of Emeline L. Kenrick, on Chelsea Creek, at East Boston.

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- Oct. 2. Merrimac River, at Rocks bridge. Proposed dumping of dredged material.
- Oct. 8. Site of proposed wharf of E. P. Wadsworth, in Duxbury harbor.
- Oct. 10. } Province lands, in Provincetown.
- Oct. 11. }
- Oct. 12. }
- Oct. 14. Delano's wharves, in New Bedford harbor.
- Nov. 6. Protective work on the Connecticut River, in Agawam.
- Nov. 7. Protective works on the Connecticut River, in Hadley, and banks of said river in the towns of Hatfield and Hadley and city of Northampton.
- Nov. 11. Charles River, at Brighton. Proposed dumping of dredged material.

LICENSES GRANTED DURING THE YEAR.

- Nos.
1862. Petition of the Lynn & Boston Railroad Company for license to dump snow and ice into Mystic River. Granted Dec. 3, 1895.
- 1863. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River and Fort Point Channel. Granted Dec. 8, 1895.
- 1864. Petition of the West End Street Railway Company for license to build a pile wharf, lay a pipe and to dredge in Mystic River in the city of Boston. Granted Dec. 24, 1895.
- 1865. Petition of the city of Boston for license to dump snow and ice into tide waters. Granted Jan. 20, 1896.
- 1866. Petition of Orlando E. Lewis for license to fill solid in Crystal Bay in the town of Winthrop. Granted Jan. 20, 1896.
- 1867. Petition of the West End Street Railway Company for license to maintain a wooden box conduit and to construct a suction well in Chelsea Creek at East Boston. Granted Jan. 20, 1896.
- 1868. Petition of Orlando F. Belcher for license to fill solid on his beach and flats at Cottage Park and Bartlett Park in the town of Winthrop. Granted Jan. 23, 1896.
- 1869. Petition of the city of Beverly for license to lay and maintain a cast-iron sewer pipe in Beverly harbor in said city. Granted Jan. 23, 1896.
- 1870. Petition of George R. Bradford for license to build a sea wall, drive piles and fill solid in Gloucester harbor in the city of Gloucester. Granted Jan. 23, 1896.

Nos.

1871. Petition of Jerome C. Borden for license to build bulkheads, drive piles and fill solid in Mount Hope Bay in the city of Fall River. Granted Jan. 23, 1896.
1872. Petition of John Killen for license to fill solid a portion of a dock in Nantucket harbor in the town of Nantucket. Granted Jan. 23, 1896.
1873. Petition of the town of Braintree for license to maintain certain filling in Little Pond in said town. Granted Feb. 5, 1896.
1874. Petition of Oliver C. Lumbert for license to build a wharf in Cotuit harbor in the town of Barnstable. Granted Feb. 5, 1896.
1875. Petition of Alexander C. Adams for license to build a wharf in Cotuit harbor in the town of Barnstable. Granted Feb. 5, 1896.
1876. Petition of John A. Morse for license to build a wharf in Cotuit harbor in the town of Barnstable. Granted Feb. 5, 1896.
1877. Petition of Winchester Smith for license to fill solid a portion of a dock on South River in the city of Salem. Granted Feb. 11, 1896.
1878. Petition of Edwin Baxter and others for license to build a dam across the outlet of Dinah's Pond in the town of Yarmouth. Granted Feb. 11, 1896.
1879. Petition of the Lynn Yacht Club for license to extend its wharf, on piles, and to maintain rafts in Lynn harbor in the city of Lynn. Granted Feb. 12, 1896.
1880. Petition of David B. Smith & Company for license to widen and extend their wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted Feb. 12, 1896.
1881. Petition of Robert K. Lufkin for license to build a sea wall and fill solid in Gloucester harbor in the city of Gloucester. Granted Feb. 12, 1896.
1882. Petition of Robert Winsor for license to build a bridge in Red Brook harbor between "Inner" Island and "Rocky" Island at Cataumet in the town of Bourne. Granted Feb. 13, 1896.
1883. Petition of Charles R. Codman for license to build and maintain a pile wharf and float stage in Cotuit harbor in the town of Barnstable. Granted Feb. 20, 1896.
1884. Petition of Lucian Newhall for license to build a sea wall and fill solid in Swampscott Bay at Red Rock in the city of Lynn. Granted Feb. 20, 1896.

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- Nos.
1885. Petition of Fanny R. Dowse for license to build a dike across the outlet connecting Phinney Bay and East Bay at Wianno in the town of Barnstable. Granted March 2, 1896.
1886. Petition of Josiah C. Bennett for license to build a bulkhead and fill solid in Lynn harbor in the city of Lynn. Granted March 3, 1896.
1887. Petition of the Plymouth Foundry Company for license to build a sea wall, fill solid and construct a building on Town Brook in the town of Plymouth. Granted March 3, 1896.
1888. Petition of Emma L. Wood for license to fill solid on her beach and flats in Boston harbor in the town of Winthrop. Granted March 16, 1896.
1889. Petition of the Boston & Maine Railroad for license to fill solid in tide water northerly of Beach street in the town of Manchester. Granted March 23, 1896.
1890. Petition of Rufus E. Snow and others for approval of plans for constructing an outlet from Sparrow's Pond in the town of Orleans, to Potanimicot River, as authorized by chapter 107 of the Acts of 1894. Granted March 23, 1896.
1891. Petition of the Boston & Maine Railroad for license to build a fender guard and dolphin in Charles River in the city of Cambridge. Granted March 25, 1896.
1892. Petition of the Boston & Nantasket Steamboat Company for license to build an addition to the wharf of the Quincy & Nantasket Steamboat Company, and to dredge in Hull Bay in the town of Hull. Granted March 25, 1896.
1893. Petition of the New York, New Haven & Hartford Railroad Company for license to build a retaining wall and fill solid in Hull harbor in the town of Hull. Granted April 6, 1896.
1894. Petition of the receivers of the Philadelphia & Reading Coal and Iron Company for license to drive piles in the dock adjoining the northerly side of their wharf on Acushnet River in the city of New Bedford, and to rebuild the easterly end of said wharf. Granted April 6, 1896.
1895. Petition of the Dartmouth Manufacturing Corporation for license to lay a 24-inch pipe and construct a stone and timber crib in New Bedford harbor in the city of New Bedford. Granted April 9, 1896.

- No.**
1896. Petition of the Carver Green Company for license to excavate a trench and draw water from Cooper's Pond in the town of Carver. Granted April 16, 1896.
1897. Petition of the Bunker Hill Yacht Club for license to build and maintain a club house, on piles, and locate and maintain float stages on the south channel of Mystic River in the city of Boston. Granted April 16, 1896.
1898. Petition of the Fiske Wharf and Warehouse Company for license to widen Harris wharf, on piles, in Boston harbor in the city of Boston. Granted April 28, 1896.
1899. Petition of the Boston & Albany Railroad Company for license to repair its Pier No. 3, Grand Junction wharves, in Boston harbor at East Boston. Granted April 28, 1896.
1900. Petition of William E. Sherriffs and Julia W. Sherriffs for license to build a wharf in Hull harbor in the town of Hull. Granted April 28, 1896.
1901. Petition of John D. W. French, trustee, for license to build a pile wharf, fill solid and to dredge in Chelsea Creek in the city of Chelsea. Granted April 29, 1896.
1902. Petition of the Boston, Revere Beach & Lynn Railroad Company for license to fill solid a portion of its bridge in Boston harbor in the town of Winthrop. Granted May 7, 1896.
1903. Petition of Nathaniel E. Harlow for license to widen Robbins wharf in Plymouth harbor in the town of Plymouth. Granted May 8, 1896.
1904. Petition of William Minot and William A. Hayes, trustees, for license to build a pile wharf on Fort Point Channel in the city of Boston. Granted May 8, 1896.
1905. Petition of John Parkinson and W. E. C. Eustis, trustees, for license to extend their wharf, on piles, and to locate and maintain a float stage in Buzzards Bay in the town of Bourne. Granted May 8, 1896.
1906. Petition of Leonard Thompson for license to widen and extend his wharf, partly solid and partly on piles, and to dredge in Hingham harbor in the town of Hingham. Granted May 11, 1896.
1907. Petition of George T. Ryder and Desire B. Ryder for license to build and maintain a flume, lay a pipe and draw water from Stillwater Pond in the town of Chatham. Granted May 14, 1896.

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- Nos.
1908. Petition of John C. Inches and George B. Inches for license to widen and extend Russia wharf, partly solid and partly on piles, on Fort Point Channel in the city of Boston. Granted May 14, 1896.
1909. Petition of the proprietors of Liverpool wharf for license to widen and extend Pearl Street wharf, partly solid and partly on piles, on Fort Point Channel in the city of Boston. Granted May 14, 1896.
1910. Petition of Jacob H. Hecht for license to build sea walls and bulkheads, drive piles and fill solid at his wharf on Fort Point Channel in the city of Boston. Granted May 19, 1896.
1911. Petition of Amelia Swanson and Augusta De Wolf for license to build a pile structure and fill solid in Boston harbor at East Boston. Granted May 20, 1896.
1912. Petition of Pope's Island Manufacturing Corporation for license to build a stone and timber bulkhead and to fill solid on Acushnet River in the city of New Bedford. Granted May 21, 1896.
1913. Petition of the Metropolitan Water Board for approval of plans for laying water pipes across Charles River at a point about 1,250 feet above Essex Street bridge, in the cities of Boston and Cambridge, as authorized by chapter 488 of the Acts of 1895. Granted May 25, 1896.
1914. Petition of the Metropolitan Water Board for approval of plans for laying water pipes across Charles River northwesterly of and near North Harvard Street bridge, in the cities of Boston and Cambridge, as authorized by chapter 488 of the Acts of 1895. Granted May 25, 1896.
1915. Petition of the Metropolitan Water Board for approval of plans for laying water pipes across Mystic River, near Middlesex Avenue bridge, in the cities of Medford and Somerville, as authorized by chapter 488 of the Acts of 1895. Granted May 25, 1896.
1916. Petition of the city of Springfield for license to build an outfall sewer on Connecticut River in said city. Granted May 25, 1896.
1917. Petition of George Parker for license to build pile wharves in Boston harbor at East Boston. Granted May 27, 1896.

- Nos.
1918. Petition of the town of Manchester for license to build and maintain a pile wharf and float stages in Manchester harbor in said town. Granted May 27, 1896.
1919. Petition of Putnam & Pope for license to widen and extend their wharf on Bass River in the city of Beverly. Granted May 27, 1896.
1920. Petition of Albert Brackett & Son for license to build a pile wharf on Charles River in the city of Boston. Granted May 28, 1896.
1921. Petition of the Board of County Commissioners of Bristol County for approval of plans for building a bridge across Acushnet River between New Bedford and Fairhaven, as authorized by chapter 368 of the Acts of 1893, and chapters 239 and 530 of the Acts of 1894. Granted May 28, 1896.
1922. Petition of Bradford D. Davol for license to build and maintain a pile wharf and float stage on Taunton Great River in the town of Dighton. Granted June 8, 1896.
1923. Petition of Slade Gorton & Co. for license to widen their wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted June 8, 1896.
1924. Petition of the Boston & Lowell Railroad Corporation for license to build two dolphins on Charles River in the city of Cambridge. Granted June 8, 1896.
1925. Petition of Anna W. Barker for license to drive piles in Half Way Pond in the town of Plymouth, and draw water from said pond. Granted June 8, 1896.
1926. Petition of the Vineyard Grove Company for approval of plans for erecting and maintaining structures in Vineyard Sound in the town of Cottage City, as authorized by chapter 299 of the Acts of 1896. Granted June 8, 1896.
1927. Petition of the Hingham Street Railway Company for license to construct wells, lay a pipe and drive piles in Hingham Bay in the town of Hingham. Granted June 8, 1896.
1928. Petition of Amos S. Brown, trustee, and Mary G. Lamper for license to build a sea wall and fill solid in Lynn harbor between said wall and Lamper's Mill Pond in the city of Lynn. Granted June 8, 1896.
1929. Petition of Susan W. Longworth for license to build and maintain a pile wharf in Beverly harbor in the city of Beverly. Granted June 8, 1896.

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- Nos.
1930. Petition of H. G. Jordan & Co. for license to build a pile wharf on Fort Point Channel in the city of Boston. Granted June 8, 1896.
1931. Petition of Emma Alexanderson for license to build a pile wharf, erect buildings and fill solid on Weymouth Fore River in the town of Weymouth. Granted June 11, 1896.
1932. Petition of the Plymouth Cordage Company for license to widen and extend its wharf and construct dolphins in Plymouth harbor in the town of Plymouth. Granted June 29, 1896.
1933. Petition of the New England Railroad Company and Old Colony Railroad Company for license to fill solid in South Bay in the city of Boston. Granted June 29, 1896.
1934. Petition of the town of Nantucket for license to fill solid between Straight wharf and Old South wharf in Nantucket harbor in said town. Granted July 7, 1896.
1935. Petition of the city of New Bedford for approval of plans for structures in Great Quittacus Pond and Little Quittacus Pond in the towns of Rochester and Lakeville, as authorized by chapter 345 of the Acts of 1894. Granted July 7, 1896.
1936. Petition of Edward S. Hamlin & Co. for license to fill solid and build a pile wharf on Neponset River in the city of Boston. Granted July 7, 1896.
1937. Petition of the West End Street Railway Company for license to fill solid, build a pile wharf, lay a pipe and dredge a channel in Dorchester Bay in the city of Boston. Granted July 7, 1896.
1938. Petition of George W. Lane for license to build a pile and timber bulkhead, drive piles, and fill solid at his wharf on South River in the city of Salem. Granted July 9, 1896.
1939. Petition of M. Louise Marshall for license to build and maintain a wharf and float stage in Quisset harbor in the town of Falmouth. Granted July 14, 1896.
1940. Petition of the Boston and Lowell Railroad Corporation for license to build a sea wall and fill solid on Miller's River in the city of Cambridge. Granted July 14, 1896.
1941. Petition of C. A. Sawyer for license to build and maintain a pile and timber wharf and boat-house in Lake Whalom in the town of Leominster. Granted July 14, 1896.

Nos.

1942. Petition of Andrew J. Litchfield for license to build and maintain a pile and timber wharf in Lake Whalom in the town of Lunenburg. Granted July 14, 1896.
1943. Petition of Horace W. Woodberry for license to extend his boat-house, on piles, in Beverly harbor in the city of Beverly. Granted July 14, 1896.
1944. Petition of the Board of County Commissioners of Bristol County for approval of plans for building a bridge over Taunton Great River, between Dighton and Berkley, as authorized and required by chapter 341 of the Acts of 1896. Granted July 16, 1896.
1945. Petition of the city of Cambridge for license to deposit ballast below and outside of the sea wall on Charles River at the "Front" in said city. Granted July 23, 1896.
1946. Petition of the city of New Bedford for approval of plans for the extension of Howland Street, and for building a sewer and filling solid in Acushnet River in the city of New Bedford, as authorized by chapter 176 of the Acts of 1883. Granted July 23, 1896.
1947. Petition of the Trustees of the Hingham and Quincy bridges for license to widen the present highway bridge on Weymouth Back River in the towns of Weymouth and Hingham. Granted July 23, 1896.
1948. Petition of the Feoffees of the grammar school in Ipswich for license to widen their wharf on Ipswich River in the town of Ipswich. Granted July 23, 1896.
1949. Petition of the New York, New Haven & Hartford Railroad Company for license to widen a portion of its bridge over Fort Point Channel at Broadway bridge in the city of Boston. Granted July 23, 1896.
1950. Petition of George H. Cavanagh and John Cavanagh for license to build a pile wharf in South Bay in the city of Boston. Granted July 28, 1896.
1951. Petition of Leroy S. Johnson for license to fill solid a portion of his pile wharf in South Bay in the city of Boston. Granted July 28, 1896.
1952. Petition of William H. Goodwin for license to build and maintain a timber pier and float stage in Salem harbor in the town of Marblehead. Granted July 31, 1896.
1953. Petition of Libbie P. Bullivant for license to build a wharf in Marion harbor in the town of Marion. Granted Aug. 18, 1896.

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- Nos.
1954. Petition of Elmer E. Tilden for license to build and maintain a pier, drop, float and runway in Hull Bay in the town of Hull. Granted Aug. 25, 1896.
1955. Petition of the Boston & Maine Railroad for license to build a culvert and to widen its road-bed on Bass River near Beverly station in the city of Beverly. Granted Sept. 4, 1896.
1956. Petition of the city of Springfield for license to build a dike on the easterly bank of the Connecticut River in said city. Granted Sept. 4, 1896.
1957. Petition of the Boston Transit Commission for approval of plans for building piers for a bridge over Charles River in the city of Boston, as authorized and required by chapter 548 of the Acts of 1894. Granted Sept. 8, 1896.
1958. Petition of the city of Lynn for approval of plans for abating nuisance on Little River in said city, as authorized by chapter 302 of the Acts of 1894. Granted Sept. 17, 1896.
1959. Petition of Harriet A. Porter for license to fill flats on Charles River adjoining Main Street in the city of Cambridge. Granted Sept. 28, 1896.
1960. Petition of the Garfield & Proctor Coal Company for license to drive piles, build a sea wall and fill solid on Acushnet River in the city of New Bedford. Granted Sept. 28, 1896.
1961. Petition of Henry A. Lambert and Sarah G. Lambert for license to build and maintain a float stage in Salem harbor at Juniper Point in the city of Salem. Granted Sept. 28, 1896.
1962. Petition of the Board of Metropolitan Sewerage Commissioners for approval of plans for laying a siphon across Charles River between Brighton and Watertown, as authorized by chapter 439 of the Acts of 1889. Granted Sept. 28, 1896.
1963. Petition of the New Bedford Yacht Club for license to drive piles for the support of a building in New Bedford harbor in the city of New Bedford. Granted Oct. 2, 1896.
1964. Petition of Emeline L. Kenrick for license to build a pile pier and dolphins on Chelsea Creek at East Boston. Granted Oct. 2, 1896.
1965. Petition of the New York, New Haven & Hartford Railroad Company for license to widen a portion of its

Nos.

- bridge over Fort Point Channel at Broadway bridge in the city of Boston. Granted Oct. 7, 1896.
1966. Petition of Edward P. Wadsworth for license to build and maintain a pile wharf and float stage in Duxbury Bay in the town of Duxbury. Granted Oct. 9, 1896.
1967. Petition of the North Shore Lumber Company for license to fill solid and build a pile wharf on Beverly Creek in the city of Beverly. Granted Oct. 19, 1896.
1968. Petition of Warren Delano for license to build a pile wharf and stone and timber cribs on Acushnet River in the town of Fairhaven. Granted Oct. 21, 1896.
1969. Petition of the city of Beverly for license to build a pile and timber structure in Beverly harbor at the easterly end of the outfall sewer opposite Andrews Court in said city. Granted Oct. 21, 1896.
1970. Petition of the city of Boston for license to drive piles in Essex Street bridge on Charles River in said city. Granted Oct. 21, 1896.
1971. Petition of the Thomson-Houston Electric Company for license to construct a pump sump and lay a pipe in Saugus River in the city of Lynn. Granted Oct. 28, 1896.
1972. Petition of the New Bedford Yacht Club for license to extend its wharf in New Bedford harbor in the city of New Bedford. Granted Oct. 28, 1896.
1973. Petition of Warren Delano, Jr., and Frederick A. Delano for license to build a sea wall, fill solid, drive piles and to dredge at "Old North Wharf" on Acushnet River in the town of Fairhaven. Granted Nov. 17, 1896.
1974. Petition of the Brookline Gas Light Company for approval of plans for laying a gas main and siphon across Fort Point Channel at Dover Street bridge in the city of Boston, as authorized by chapter 405 of the Acts of 1895. Granted Nov. 17, 1896.
1975. Petition of the Hingham Street Railway Company for license to lay a cable under the channel of Weymouth Back River in the town of Hingham. Granted Nov. 20, 1896.
1976. Petition of the Lowell, Lawrence & Haverhill Street Railway Company for license to lay and maintain cables in and under Merrimac River in the city of Haverhill and towns of Bradford and Groveland. Granted Nov. 20, 1896.

MISCELLANEOUS PERMITS.

The Board has granted during the year forty-two miscellaneous permits, in addition to the licenses for structures in tide water, great ponds and Connecticut River, previously mentioned. These permits were: for dredging; for the removal of material from certain beaches; for dumping material dredged from certain localities; for placing a mooring buoy and dolphin; for driving piles for temporary purposes; for using a portion of the Commonwealth's land at South Boston; and for authorizing the publication of notices by the New York, New Haven & Hartford Railroad Company, in the name of the Board, for closing Fort Point Channel to the passage of vessels through the bridge of said company for the purpose of making necessary repairs to said bridge.

TIDE-WATER ASSESSMENTS AND HARBOR COMPENSATION FUND.

There was paid into the treasury of the Commonwealth during the year, under section 14 of chapter 19 of the Public Statutes, \$5,983.05 in payment for tide water displaced by work done under licenses granted by the Board, and \$1,200 in payment for gravel removed from Neponset River and Charles River under permits from the Board, making a total of \$7,183.05 credited to the harbor compensation fund for Boston harbor.

The amount in the harbor compensation fund for Boston harbor on Nov. 30, 1896, was \$231,120.21. The income from this fund on the same date was \$5,704.65.

RECEIPTS FROM GRANTS OF PUBLIC LANDS.

There was paid into the treasury of the Commonwealth during the year, under the provisions of section 16 of chapter 19 of the Public Statutes and chapter 318 of the Acts of 1888, for grants of rights and privileges in tide waters and great ponds under licenses from the Board, the sum of \$34,187.25.

In addition to the payments above mentioned, \$353.32 was paid for releases of Back Bay lands, \$100 for rent of

Hangman's Island, and \$50.20 for gravel removed from Lynn harbor.

By chapter 313 of the Acts of 1864, all net receipts from sales of public lands were to be paid into a sinking fund established by this act.

By chapter 122 of the Acts of 1865, the Massachusetts war fund was established, section 3 of this act providing that a sinking fund be created, composed in part of receipts from public lands or flats not already appropriated for specific purposes.

By chapter 8 of the Resolves of 1872, the income of the war loan sinking fund is to be credited to the Troy & Greenfield Railroad sinking fund.

Payment for grants of tide-water lands of the Commonwealth was first required by chapter 284 of the Acts of 1874, and since the passage of that act the total amount received and paid into the treasury of the Commonwealth and credited to the Troy & Greenfield Railroad loan sinking fund is \$408,820.95. The amount received during the year from rents of the Commonwealth's lands at South Boston, and paid into the Commonwealth's flats improvement fund, is \$2,988.90, as already stated.

The income of the harbor compensation fund for Boston harbor is inadequate to the growing demands on it. With the expansion of commerce and the size of vessels this demand may be expected to increase. The building of this fund by the proceeds of assessments for tide water displaced was a natural sequence from the adoption of the policy of assessment. There is, however, another property right which might with propriety be made to contribute to swelling this fund, and that is the proceeds of the sale of the Commonwealth's land under tide waters. Hitherto the proceeds of such sales have been devoted to the war loan sinking fund and afterwards to the sinking fund of the Troy & Greenfield Railroad. The latter will be filled in September, 1897; and it is submitted that no more appropriate diversion of it could be made than toward the increase of that fund the income of which is forever devoted to the improvement of the harbor, the area of which is diminished by the sale of the tide lands. The income from

the proceeds of the diminution of the tide-water areas will thus be used to deepen the approaches.

NEW QUARTERS.

The Board takes great pleasure in making due acknowledgment for its new and commodious quarters, Nos. 129-133 inclusive, in the State House Extension. We at last feel that now we can gather together in one set of connected rooms all the valuable maps, plans, books and papers in the custody of the Board and preserve them, arranged in a manner most appropriate for daily use, under conditions such as reduce to a minimum the danger from fire. The apartment next adjoining and originally designed to go with those appropriated to the use of the Board it is hoped, when the State House is completed, will be added, thus affording the Board the fullest accommodation for the prosecution of its work.

SALARIES OF THE COMMISSIONERS.

Again, it is thought proper to invite the attention of the Legislature to the very inadequate salaries of the Commissioners. There is, comparatively speaking, not a large amount of clerical work connected with the functions of the Board. Keeping a full and correct record of the hearings, the findings of the Board, preparing the licenses to be issued, and giving daily information in answer to inquiries and maintaining correspondence, occupy the greater portion of the time of the secretary. The engineering work requires great care and study, and is continually adding most valuable data to the topographical records of the Commonwealth. The functions of the Board itself are largely judicial and are more frequently invoked in determining questions of public policy mingled with more or less law, and in so shaping the conclusions reached on the particular facts of the petitions presented as to bring them in harmony with declared policy.

The foregoing report is respectfully submitted by

WOODWARD EMERY,
JOHN I. BAKER,
CHARLES H. HOWLAND,
Commissioners.



APPENDIX.

APPENDIX.

[A.]

[See page 8 of this report, *ante.*]

CONTRACT.

ARTICLES OF AGREEMENT, MADE THIS TWENTY-SECOND DAY OF OCTOBER IN THE YEAR EIGHTEEN HUNDRED AND NINETY-SIX, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY THE BOARD OF HARBOR AND LAND COMMISSIONERS WITH THE APPROVAL OF THE GOVERNOR AND COUNCIL, AND THE NEW ENGLAND DREDGING COMPANY, A CORPORATION DULY ESTABLISHED UNDER THE LAWS OF SAID COMMONWEALTH, HEREINAFTER DESIGNATED AS THE CONTRACTOR.

The contractor hereby covenants and agrees with the Commonwealth to do and complete all the work necessary and proper to excavate by dredging a channel in South Boston flats, just east of Slate Ledge, all the work to be done and completed in the manner and in accordance with and subject to the terms and conditions set forth in the following specifications.

The word "engineer" when used herein shall mean the engineer of the Board of Harbor and Land Commissioners acting directly or through his properly authorized agents, such agents acting within the scope of the particular duties intrusted to them.

Specifications.

The contractor is to furnish all the plant, tools, appliances and labor necessary to do the work contracted for, as follows: —

The channel to be dredged is about 1,550 feet long. It begins at a point 100 feet north-easterly of the north-easterly bulkhead, inclosing the filled portion of the South Boston flats and about 250 feet north-westerly of the easterly corner of the bulkhead, and thence extends north-easterly to the three-fathom curve on the southerly side of the main channel of the harbor. It is to be 75 feet wide on the bottom and 18 feet deep at mean low water, and the banks at the sides and end are to be sloped up on an angle not steeper than 2 to 1, said slopes to be outside of the main por-

tion of the channel, which is 75 feet wide. The exact location and a cross-section showing the shape of the channel to be excavated are shown on a plan on file in the office of the Board of Harbor and Land Commissioners, entitled "Plan showing channel to be dredged in South Boston flats. September, 1896. Scale, $\frac{1}{1000}$."

The amount of material between the present bottom and the plane of 18 feet below mean low water within the channel lines is as follows, to wit:—

	Cubic yards.
	89,200
In the side slopes,	12,300
	<hr/>
Total,	51,500

The least present depth of water within the limits of the channel is about 4 feet at mean low water, and the average cut is about 9.1 feet.

The above-described channel is to be dredged so that it shall have, when the work is completed, a cross-section throughout as hereinbefore described, and no extra payment or allowance to be made for any excavation below the required depth, or outside of the required cross-section.

The material excavated may be dumped on the portion of the South Boston flats lying easterly of the filled portion of the flats, northerly of a line in extension of a line parallel with and 50 feet northerly of the sea wall on the northerly side of the reserved channel and south-westerly of a line in extension of a line 25 feet south-westerly of the north-westerly bulkhead at such places within said area and in such manner as may be prescribed from time to time by the engineer. Two or more piles to be driven and maintained by the contractor upon each of the northerly and southerly limits of the dumping area to mark them during the progress of the work, and to be removed by him upon the completion of the work, if required by the engineer. If the contractor prefers, the material may be dumped in deep water east of a line drawn straight between Egg Rock and Minot's Light, or such other disposition may be made of the material as shall be approved by said Board.

All ledges and bowlders which may be found, and which can be removed by dredging, to be removed as part of the contract, without extra payment or allowance; but if any ledges or bowlders are found which cannot be removed by dredging, the covering material to be dredged away and the ledges and bowlders left bare to the depth aforesaid; and the engineer to be the sole judge to

determine whether any ledge or boulder can be removed by dredging or not.

The work to be done in such a way as not to unreasonably interfere with the construction simultaneously of a pile wharf along the south-easterly side of the 75 feet channel from its inner end to a point 400 feet from the bulkhead, and two dolphins on the same line, one 550 feet and one 800 feet from the bulkhead.

The aforesaid plan, and the surveys and calculations based thereon, are believed to be correct; but the contractor must examine for himself, as no allowance will be made for any errors or inaccuracies which may be found therein.

In all questions which may arise concerning measurements, lines and grades, or of interference with the work of other contractors, the decision of the engineer to be final. All lines and grades will be given by the engineer, but all necessary aid and materials for giving or indicating them to be furnished by the contractor at his own expense, and the marks given shall be carefully preserved.

Convenient facilities for the inspection of the work to be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed; and when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which they are given.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced as soon as practicable, and to be prosecuted vigorously in all suitable weather until completion, and to be fully completed on or before the first day of March, 1897.

Estimates to be made by the engineer of the amount of work done up to the end of each calendar month, and payment to be made thereon of 75 per centum of the proportional part of the contract price applicable to such work, as computed by the engineer; the remaining 25 per centum to be paid upon the final completion and acceptance of the whole work.

In all operations connected with the work the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work or the methods of doing the work, and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work; and in the employment of mechanics and laborers in the

construction of the work herein contracted for preference shall be given by the contractor to citizens of the United States, in accordance with the requirements of chapter 494 of the Acts of 1896.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished for the work, or to inventions, patents, or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or to any act, omission or neglect of the contractor or his employees therein.

If the work to be done under this contract shall be abandoned by the contractor, or if the engineer at any time shall be of opinion, and shall so certify in writing to said Board of Harbor and Land Commissioners, that the work, or any part thereof, is unnecessarily or unreasonably delayed, or that the contractor is violating any of the provisions of this contract, said Board may notify the contractor to discontinue the work, and the contractor shall thereupon discontinue said work, and the Commonwealth may, after the said notice, complete the work by contract or otherwise, and may pay the expense of the same so far as may be out of any moneys then due or to become due the contractor under this contract. In case such expense is less than the sum which would have been payable under this contract if the same had been completed by the contractor, the contractor shall be entitled to receive the difference, and in case the expense shall exceed said sum the contractor shall pay the amount of such excess to the Commonwealth.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the contractor the sum of thirteen thousand nine hundred and forty-five (13,945) dollars in full therefor, at the times and in the manner and upon the terms and conditions hereinbefore set forth.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council; and the said New

England Dredging Company, by Charles H. Souther its president, thereto duly authorized, has caused these presents to be signed and delivered in its name and behalf and its corporate seal to be hereunto affixed.

THE COMMONWEALTH OF MASSACHUSETTS,

By WOODWARD EMERY, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

NEW ENGLAND DREDGING COMPANY,

By CHARLES H. SOUTHER, *President.* [SEAL OF NEW ENGLAND
DREDGING COMPANY.]

COMMONWEALTH OF MASSACHUSETTS.

Approved in Council. Oct. 29, 1896.

EDWARD F. HAMLIN,
Executive Clerk.

Witness the seal of the Commonwealth:

[SEAL OF THE
COMMONWEALTH.]

WM. M. OLIN,
Secretary.

[B.]

[See page 8 of this report, *ante*.]

CONTRACT.

ARTICLES OF AGREEMENT, MADE THIS NINETEENTH DAY OF OCTOBER IN THE YEAR EIGHTEEN HUNDRED AND NINETY-SIX, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY THE BOARD OF HARBOR AND LAND COMMISSIONERS WITH THE APPROVAL OF THE GOVERNOR AND COUNCIL, AND ALBERT A. HERSEY OF EAST BOSTON, IN THE COUNTY OF SUFFOLK, HEREINAFTER DESIGNATED AS THE CONTRACTOR.

The contractor hereby covenants and agrees with the Commonwealth to provide all the materials and to do and complete all the work necessary and proper to build an oak pile wharf and two dolphins on South Boston flats in Boston Harbor, all the work to be done and completed in the manner and in accordance with and subject to the terms and conditions set forth in the following specifications.

The word "engineer" when used herein shall mean the engineer of the Board of Harbor and Land Commissioners acting directly or through his properly authorized agents, such agents acting within the scope of the particular duties intrusted to them.

Specifications.

The contractor is to furnish all the plant, tools, appliances, labor and materials necessary to build the wharf and dolphins and put them in condition for use, as follows : —

The wharf is to be located on the South Boston flats, near the north-easterly corner of the filled flats, and is to extend from the filled flats north-easterly toward the main channel of the harbor. It is to be 400 feet long, the inner 350 feet to be 30 feet wide, and the remaining 50 feet to be 50 feet wide. It is to be built of oak piles and braces and hard pine timber, and is to have a bulkhead or breakwater of spruce timber and plank running throughout its length and secured to the piles of the wharf.

Two dolphins, of four oak piles each, to be built in line with the north-westerly side of the wharf, one 150 feet and one 400 feet north-easterly from the northerly corner of the wharf.

A plan on file in the office of the Board of Harbor and Land Commissioners, marked, "Plan of proposed wharf on South Boston flats, September, 1896," signed by Frank W. Hodgdon, engineer, shows the location, size and method of construction of the wharf, and is referred to and made a part of these specifications and is to be followed in all details not otherwise mentioned.

Piles and Pile-work.

All piles are to be new oak piles, sound and straight, at least 14 inches in diameter at a point 5 feet from the butt, and not less than 8 inches in diameter at the small end, including the bark in both cases, and are to be of proper lengths for driving, cutting off and capping at the proper grade. The main piles to be not less than 40 nor more than 45 feet in length. All piles must be free from defects of every kind (no knotty, rotten or worm-eaten, split, peeled or partly peeled or loose-bark piles will be accepted), and must be carefully and thoroughly driven to the satisfaction of the engineer. Any pile which may be driven in a wrong position, or which may not be long enough for capping after being driven, or which may be split in driving, shall be drawn up and another substituted.

All spur-shores are to be fitted in a workmanlike manner and bolted to the piles with $1\frac{1}{4}$ -inch screw bolts. The fender piles to be bolted to the main piles with $1\frac{1}{4}$ -inch screw-bolts with counter-sunk heads.

Belay posts to be large-sized piles with well-shaped butts, and driven in the location shown on the plan, and shaped, fitted and secured in the manner shown thereon.

Each bent of piles in the narrow section of the wharf, and each row of piles extending back from the three outer faces of the wide portion of the wharf, are to be braced with rough oak braces as shown on the plan. The girders and braces are to be hewn or sawed on one side and are to be large enough to square at least 4 inches by 5 inches at the small end; all to be fastened to the piles by one 1-inch screw-bolt in each bearing.

Dolphins.

The dolphins to consist of one main pile and three spur-shores each. Each spur-shore to be bolted to the main pile by one $1\frac{1}{4}$ -inch screw-bolt. The piles in each dolphin to be further bound together by $3\frac{1}{2}$ fathoms of 1-inch iron chain placed and secured in a manner to be approved by the engineer.

Floor.

The main piles are to be capped with 6-inch by 10-inch double girder caps, which are to extend in one length entirely across the wharf throughout the narrow portion, and are to be bolted to the piles with two 1-inch screw-bolts in each pile, with two additional bolts at each butt joint. The floor to consist of stringers spaced two feet on centres, each stringer to extend over at least two bents and are to break joints throughout. The stringers next to fender caps and one other throughout the length of the wharf to be 10 inches by 12 inches, all others to be 6 inches by 12 inches. They are to be secured to caps by $\frac{3}{4}$ -inch spike-bolts 18 inches long, one bolt in each end and one in each other bearing. This to be covered by 3-inch hard pine plank, laid heart side up, well spiked to the stringers with 7-inch steel wire nails, two nails in each bearing. Plank to be laid with $\frac{1}{4}$ -inch open joints. Along the back side of the wharf and wherever there is no fender cap a strip of plank 3 inches by 8 inches will be spiked on top of the flooring plank in place of a fender cap, and the flooring plank to be cut flush with its outer edge. The fender piles to be capped with a solid 12-inch by 12-inch hard pine cap with scarfed joints, each scarf bolted with four $\frac{3}{4}$ -inch screw-bolts. Ten ring-bolts as shown on plan, or such as may be approved by the engineer, to be placed in the wharf, thoroughly secured in a manner satisfactory to the engineer.

The two outer corners of the wharf to be constructed as shown by the detailed plan. The four middle fender piles in each corner to extend four feet above the floor of the wharf, to be rounded and finished as directed by the engineer. An iron strap 6 inches by $\frac{1}{2}$ inch to be securely bolted around the two outer corners on a level with the fender cap. The wharf to be connected with and attached to the bulkhead enclosing the filled flats, in a manner to be approved by the engineer.

Bulkhead or Breakwater.

A bulkhead or breakwater to be built as shown on said plan, extending the whole length of the wharf. To consist of two spruce stringers, each 8 inches by 10 inches, bolted to the main piles of the wharf, one just under the girder caps, the under side of the other to be one foot above mean low water. The stringers to break-joint with each other, the joints to come between the piles and to be spliced by bolting a piece of the same size, not less than 3 feet long, on the back side of the stringer with four

$\frac{3}{4}$ -inch screw-bolts. Upon this to be spiked 3-inch spruce plank not less than 22 feet long, extending from the under side of the floor of the wharf into the bottom of the harbor. Spikes to be large steel wire spikes, 7 inches long. There are to be two spikes in each bearing. The planks to be further secured by two strips of plank 3 inches by 6 inches, extending throughout the length of the bulkhead and bolted through to the two stringers by $\frac{3}{4}$ -inch screw-bolts, one every six feet, with additional bolts at the joints when necessary.

Quality of Timber.

All timber used to be sound, straight-grained, of full size, rectangular in section, and of even thickness. All hard pine to be of quality known as "Prime." Spruce shall be sound, sawed square and free from large knots. The Commonwealth will furnish and deliver to the contractor, at its office building on the South Boston flats, one barrel of "Carbolineum Avenarius," a wood preservative. The contractor to furnish the necessary tools and labor to apply the preservative to such portion of the lumber used in the construction of the wharf, and in such manner as the engineer may direct. The lumber to which it is applied must be as dry as possible, and, if required by the engineer, must be stacked under cover for at least one week immediately before the preservative is applied.

Bolts.

All bolts to be best double refined wrought iron, and all screw-bolts to have nuts and washers of such sizes as shall be approved by the engineer.

General Clauses.

The work shall be done so as not to unreasonably interfere with the work of dredging the berth for vessels alongside the north-westerly side of the wharf and the channel leading from it to the main channel.

Upon the completion of the work, the contractor to remove from the premises all materials and refuse left from the construction, and to leave the premises in a condition satisfactory to the engineer.

The drawings and specifications are intended to be explanatory of each other; but should any discrepancy appear, or any misunderstanding arise as to the import of anything contained in either, the explanation and determination of the engineer shall be considered final and binding on the contractor. Any errors or omissions in drawings or specifications may be corrected by the engineer, such correction to govern all work only from the time that the engineer gives due notice thereof.

In all questions which may arise concerning measurements, lines and grades, or of interference with other work or contractors, the decision of the engineer to be final. All lines and grades will be given by the engineer, but all necessary aid and materials for giving or indicating them to be furnished by the contractor at his own expense, and the marks given shall be carefully preserved.

Any materials condemned or rejected by the engineer may be branded or otherwise marked, and shall, on demand, be at once removed from the work.

Any unfaithful or imperfect work which may be discovered before the final acceptance of the work shall be corrected immediately, and any unsatisfactory materials delivered shall be rejected on the requirement of the engineer, notwithstanding that they may have been overlooked in previous inspection. The inspection of the work shall not relieve the contractor of any of his obligations to perform good work as herein prescribed; and all work of whatever kind which, during its progress and before it is finally accepted, may become damaged from any cause, shall be removed and replaced by good and satisfactory work.

Convenient facilities for the inspection of the work shall be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed, and when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which they are given.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced as soon as practicable and to be prosecuted vigorously in all suitable weather until completion, and to be fully completed on or before the first day of March, 1897.

In all operations connected with the work the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work, or the methods of doing the work, and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work, and in the employment of mechanics and laborers in the construction of the work herein contracted for preference shall be given by the contractor to citizens of the United States, in accordance with the requirements of chapter 494 of the Acts of 1896.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished for the work, or to inventions, patents, or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or to any act, omission or neglect of the contractor or his employees therein.

If the work to be done under this contract shall be abandoned by the contractor, or if the engineer at any time shall be of opinion, and shall so certify in writing to said Board of Harbor and Land Commissioners, that the work or any part thereof is unnecessarily or unreasonably delayed, or that the contractor is violating any of the provisions of this contract, said Board may notify the contractor to discontinue the work and the contractor shall thereupon discontinue said work, and the Commonwealth may, after the said notice, complete the work by contract or otherwise, and may pay the expense of the same so far as may be out of any moneys then due or to become due the contractor under this contract. In case such expense is less than the sum which would have been payable under this contract if the same had been completed by the contractor, the contractor shall be entitled to receive the difference; and in case the expense shall exceed said sum, the contractor shall pay the amount of such excess to the Commonwealth.

Estimates to be made by the engineer at the end of each calendar month of the value of the work completed in place, and payment to be made thereon of 75 per centum of the value of said work, as computed by the engineer, the remaining 25 per centum to be paid upon the final completion and acceptance of the whole work.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the contractor the sum of seven thousand four hundred and thirty-eight (7,438) dollars in full therefor, at the times and in the manner and upon the terms and conditions hereinbefore set forth.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Common-

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wealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council ; and the said Albert A. Hersey has hereunto set his hand and seal.

ALBERT A. HERSEY,

[SEAL.]

THE COMMONWEALTH OF MASSACHUSETTS.

By WOODWARD EMERY, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

COMMONWEALTH OF MASSACHUSETTS.

In Council, Oct. 22, 1896.

EDWARD F. HAMLIN,
Executive Clerk.

Witness the seal :

[SEAL OF THE
COMMONWEALTH.]

WM. M. OLIN,
Secretary of the Commonwealth.

[C.]

[See page 12 of this report, *ante*.]

CONTRACT.

ARTICLES OF AGREEMENT, MADE THIS ELEVENTH DAY OF JUNE, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-SIX, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY THE BOARD OF HARBOR AND LAND COMMISSIONERS WITH THE APPROVAL OF THE GOVERNOR AND COUNCIL, AND THE NEW ENGLAND DREDGING COMPANY, A CORPORATION DULY ESTABLISHED UNDER THE LAWS OF SAID COMMONWEALTH, HEREINAFTER DESIGNATED AS THE CONTRACTOR.

The contractor hereby covenants and agrees with the Commonwealth to do and complete all the work necessary and proper to deepen by dredging two areas in Boston Harbor opposite the Grand Junction wharves in East Boston, all the work to be done and completed in the manner and in accordance with and subject to the terms and conditions set forth in the following specifications.

The word "engineer" when used herein shall mean the engineer of the Board of Harbor and Land Commissioners acting directly or through his properly authorized agents, such agents acting within the scope of the particular duties intrusted to them.

Specifications.

The contractor is to furnish all the plant, tools, appliances and labor necessary to do the work contracted for, as follows:—

The areas to be dredged lie in front of the Grand Junction wharves in East Boston, and extend from a line 50 feet outside of and parallel with the harbor line to the main channel of the harbor. The first area lies between the two areas which were dredged by the Commonwealth in 1895, opposite the Cunard wharf and opposite Dock No. 6 of the Grand Junction wharves. The second area lies between the area dredged in 1895, opposite Dock No. 6 and a line parallel with and 150 feet easterly from the prolongation, south-westerly, of the south-easterly side line of Pier No. 7 of the Grand Junction wharves. The first area contains about 282,650 square feet, and the second about 450,100 square feet.

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The location and dimensions of both areas are more exactly shown on a plan on file in the office of the Board of Harbor and Land Commissioners, entitled "Plan of areas to be dredged off Grand Junction wharves, East Boston. May, 1896. Scale, $\frac{1}{800}$." Said plan is referred to and made a part of these specifications.

The amount of material between the present bottom and the plane of 27 feet below mean low water is as follows, to wit: —

	Cubic Yards.
On the first area,	32,000
On the second area,	95,000
Total,	<u>127,000</u>

The least present depth of water on the first area is about 21.3 feet at mean low water, and the average cut is about 3 feet; and on the second the least depth is about 9.4 feet and the average cut about $5\frac{1}{2}$ feet.

The above-described areas are to be dredged so that they shall have, when the work is completed, a depth throughout of not less than 27 feet below the plane of mean low water.

The banks at the edges of the above-described areas to be sloped off sufficiently to maintain the required depth over the whole of said areas, and no extra payment or allowance to be made for such sloping, nor for any excavation below the required depth.

The material excavated to be dumped in deep water east of a line drawn straight between Egg Rock and Minot's Light; or such other disposition may be made of the material as shall be approved by said Board.

All ledges and boulders which may be found, and which can be removed by dredging, to be removed as part of the contract without extra payment or allowance; but if any ledges or boulders are found which cannot be removed by dredging, the covering material to be dredged away and the ledges and boulders left bare to the depth aforesaid; and the engineer to be the sole judge to determine whether any ledge or boulder can be removed by dredging or not.

The aforesaid plan, and the surveys and calculations based thereon, are believed to be correct, but the contractor must examine for himself, as no allowance will be made for any errors or inaccuracies which may be found therein.

In all questions which may arise concerning measurements, lines and grades, the decision of the engineer to be final. All lines and grades will be given by the engineer, but all necessary aid and materials for giving or indicating them to be furnished by the contractor at his own expense, and the marks given shall be carefully preserved.

Convenient facilities for the inspection of the work to be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed, and when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which they are given.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced as soon as practicable, and to be prosecuted vigorously in all suitable weather until completion, and to be fully completed on or before the first day of December, 1896.

Estimates to be made by the engineer of the amount of work done up to the end of each calendar month, and payment to be made thereon of 75 per centum of the proportional part of the contract price applicable to such work, as computed by the engineer; the remaining 25 per centum to be paid upon the final completion and acceptance of the whole work.

In all operations connected with the work, the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work, or the methods of doing the work, and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished for the work, or to inventions, patents, or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or to any act, omission or neglect of the contractor or his employees therein.

If the work to be done under this contract shall be abandoned by the contractor, or if the engineer at any time shall be of opinion, and shall so certify in writing to said Board of Harbor and Land Commissioners, that the work or any part thereof is unnecessarily or unreasonably delayed, or that the contractor is violating any of the provisions of this contract, said Board may

notify the contractor to discontinue the work and the contractor shall thereupon discontinue said work, and the Commonwealth may thereupon complete the work by contract or otherwise, and may pay the expense of the same so far as may be out of any moneys then due or to become due the contractor under this contract. In case such expense is less than the sum which would have been payable under this contract if the same had been completed by the contractor, the contractor shall be entitled to receive the difference; and in case the expense shall exceed said sum, the contractor shall pay the amount of such excess to the Commonwealth.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the contractor the sum of forty-eight thousand two hundred and eighty (48,280) dollars in full therefor, at the times and in the manner and upon the terms and conditions hereinbefore set forth.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council; and the said New England Dredging Company, by Charles H. Souther, its president and treasurer, thereunto duly authorized, has caused these presents to be signed and delivered in its name and behalf, and its corporate seal to be hereunto affixed.

THE COMMONWEALTH OF MASSACHUSETTS,

By WOODWARD EMERY,
JOHN I. BAKER,
CHAS. H. HOWLAND, } *Harbor and Land
Commissioners.*

NEW ENGLAND DREDGING COMPANY,

By CHARLES H. SOUTHER, [SEAL OF THE N. E.
President and Treasurer. DREDGING CO.]

COMMONWEALTH OF MASSACHUSETTS.

In Council, June 23, 1896.

[SEAL OF THE
COMMONWEALTH.]

E. F. HAMLIN,
Executive Clerk.

[D.]

[See page 12 of this report, *ante*.]

CONTRACT.

ARTICLES OF AGREEMENT, MADE THIS EIGHTH DAY OF JULY, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-SIX, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY THE BOARD OF HARBOR AND LAND COMMISSIONERS WITH THE APPROVAL OF THE GOVERNOR AND COUNCIL, AND THE EASTERN DREDGING COMPANY, A CORPORATION ESTABLISHED UNDER THE LAWS OF THE STATE OF MAINE, AT PORTLAND IN SAID STATE, HEREINAFTER DESIGNATED AS THE CONTRACTOR.

The contractor hereby covenants and agrees with the Commonwealth to do and complete all the work necessary and proper to deepen by dredging an area in Boston Harbor opposite the Mystic wharves in Charlestown, all the work to be done and completed in the manner and in accordance with and subject to the terms and conditions set forth in the following specifications.

The word "engineer" when used herein shall mean the engineer of the Board of Harbor and Land Commissioners acting directly or through his properly authorized agents, such agents acting within the scope of the particular duties intrusted to them.

Specifications.

The contractor is to furnish all the plant, tools, appliances and labor necessary to do the work contracted for, as follows:—

The area to be dredged lies in front of the Mystic wharves and docks below Chelsea bridge in Charlestown, and extends from a line 50 feet outside of and parallel with the harbor line to the main channel of the harbor, and contains about 1,041,000 square feet. The location and dimensions of the area are more exactly shown on a plan on file in the office of the Board of Harbor and Land Commissioners, entitled "Plan of area to be dredged off Mystic wharves, Charlestown. June, 1896. Scale, 1/1000." Said plan is referred to and made a part of these specifications.

The amount of material between the present bottom and the plane of 27 feet below mean low water is as follows, to wit: about 218,000 cubic yards.

The least present depth of water on the area is about 3 feet at mean low water, and the average cut is about 5.2 feet.

The above-described areas are to be dredged so that they shall have, when the work is completed, a depth throughout of not less than 27 feet below the plane of mean low water.

The banks at the edges of the above-described areas to be sloped off sufficiently to maintain the required depth over the whole of said areas, and no extra payment or allowance to be made for such sloping, nor for any excavation below the required depth.

The material excavated to be dumped in deep water east of a line drawn straight between Egg Rock and Minot's Light, or such other disposition may be made of the material as shall be approved by said Board.

All ledges and boulders which may be found, and which can be removed by dredging, to be removed as part of the contract without extra payment or allowance; but if any ledges or boulders are found which cannot be removed by dredging, the covering material to be dredged away and the ledges and boulders left bare to the depth aforesaid; and the engineer to be the sole judge to determine whether any ledge or boulder can be removed by dredging or not.

The aforesaid plan, and the surveys and calculations based thereon, are believed to be correct, but the contractor must examine for himself, as no allowance will be made for any errors or inaccuracies which may be found therein.

In all questions which may arise concerning measurements, lines and grades, the decision of the engineer to be final. All lines and grades will be given by the engineer, but all necessary aid and materials for giving or indicating them to be furnished by the contractor at his own expense, and the marks given shall be carefully preserved.

Convenient facilities for the inspection of the work to be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed, and when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which they are given.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced as soon as practicable, and to be prosecuted vigorously in all suitable weather until completion, and to be fully completed on or before the first day of July, 1897.

Estimates to be made by the engineer of the amount of work done up to the end of each calendar month, and payment to be made thereon of 75 per centum of the proportional part of the contract price applicable to such work, as computed by the engineer; the remaining 25 per centum to be paid upon the final completion and acceptance of the whole work.

In all operations connected with the work, the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work, or the methods of doing the work, and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished for the work, or to inventions, patents, or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or to any act, omission or neglect of the contractor or his employees therein.

If the work to be done under this contract shall be abandoned by the contractor, or if the engineer at any time shall be of opinion, and shall so certify in writing to said Board of Harbor and Land Commissioners, that the work or any part thereof is unnecessarily or unreasonably delayed, or that the contractor is violating any of the provisions of this contract, said Board may notify the contractor to discontinue the work and the contractor shall thereupon discontinue said work, and the Commonwealth may thereupon complete the work by contract or otherwise, and may pay the expense of the same so far as may be out of any moneys then due or to become due the contractor under this contract. In case such expense is less than the sum which would have been payable under this contract if the same had been completed by the contractor, the contractor shall be entitled to receive the difference; and in case the expense shall exceed said sum, the contractor shall pay the amount of such excess to the Commonwealth.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and condi-

tions aforesaid, hereby covenants and agrees to pay the contractor the sum of eighty-nine thousand two hundred and twenty-five (89,225) dollars in full therefor, at the times and in the manner and upon the terms and conditions hereinbefore set forth.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council; and the said Eastern Dredging Company, by George E. Runyan, its treasurer, thereunto duly authorized, has caused these presents to be signed and delivered in its name and behalf, and its corporate seal to be hereunto affixed.

EASTERN DREDGING COMPANY,

By GEORGE E. RUNYAN, [SEAL OF THE EASTERN
DREDGING COMPANY.]
Treasurer.

THE COMMONWEALTH OF MASSACHUSETTS.

By WOODWARD EMERY, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

COMMONWEALTH OF MASSACHUSETTS.

In Council, July 9, 1896.

EDWARD F. HAMLIN,
Executive Clerk.

COMMONWEALTH OF MASSACHUSETTS.

OFFICE OF THE SECRETARY.

Witness the seal of the Commonwealth:

WM. M. OLIN,
Secretary.

[SEAL OF THE
COMMONWEALTH.]

[E.]

[See page 25 of this report, *ante.*]

WARNING.

All persons are hereby warned against pulling or destroying any vegetable growth of any kind within the Province Lands belonging to the Commonwealth.

Any violation of this warning will be deemed a trespass and treated accordingly.

WOODWARD EMERY,
JOHN I. BAKER,
CHAS. H. HOWLAND,
Harbor and Land Commissioners.

Boston, May 28, 1896.

[F.]

[See page 32 of this report, *ante*.]

SUPERIOR COURT.

SUFFOLK, ss.

1896.

MARY G. FISK ET AL., PETITIONERS, *v.* COMMONWEALTH OF
MASSACHUSETTS.

Decree.

This case came on to be heard at this sitting after summons to claimants as provided in chapter 17 of the Resolves of the General Court passed in the year 1896, and no claimants other than the petitioners having appeared within ten days after the return day of said summons, except Benjamin F. Brown of Lexington in the County of Middlesex and said Commonwealth; who claims to own flats described in deed of George G. Crocker et al., to him recorded with Middlesex South District Deeds, Book 2,437, page 531, and who assents to this decree, said cause was argued by counsel, and thereupon and upon consideration thereof, and upon the assent of the petitioners and of the Commonwealth.

It is ordered, considered, adjudged and decreed that the true boundary line separating the lands and flats of the petitioners from the land and flats of the Commonwealth is, and it is hereby ascertained and established as follows: The said boundary line runs along the land and flats in the Charles River in the limits of the city of Cambridge, and is all that portion of a broken line, made up of a series of straight lines, which is included between the north-easterly and westerly boundary lines of the land and flats described in chapter forty-nine of the Resolves of the General Court passed in the year 1895, as conveyed by Makepeace to Skinner & Hurd.

Said broken line is fixed by points located by distances (measured in horizontal lines drawn at right angles), (1) from the northerly line of Beacon street in the city of Boston, hereinafter called reference line number one, and (2) from a line beginning at the point of intersection of the said northerly line of Beacon street with the easterly line (extended) of Dartmouth street, as now laid out between Commonwealth avenue and Beacon street in said Boston, and running northerly therefrom at a right angle with said line of Beacon street across said land and flats, the same being

hereinafter called reference line number two; and said points are fixed as follows: Point A is distant northerly nineteen hundred and eighty-one (1,981) feet from reference line number one, and distant easterly fifteen hundred and fifty-six (1,556) feet from reference line number two; point B is distant northerly seventeen hundred and forty-one (1,741) feet from reference line number one, and distant easterly twelve hundred and eighty-six (1,286) feet from reference line number two; point C is distant northerly fourteen hundred and sixty-six (1,466) feet from reference line number one, and distant easterly six hundred and ninety-eight (698) feet from reference line number two; point D is distant northerly fourteen hundred and one (1,401) feet from reference line number one, and distant easterly eighty-seven (87) feet from reference line number two; point E is distant northerly fourteen hundred and ninety-one (1,491) feet from reference line number one, and distant westerly two hundred and forty-four (244) feet from reference line number two; point F is distant northerly fifteen hundred and twenty-one (1,521) feet from reference line number one, and distant westerly six hundred and sixty-eight (668) feet from reference line number two; point G is distant northerly eighteen hundred and twelve (1,812) feet from reference line number one, and distant westerly sixteen hundred and twenty-four (1,624) feet from reference line number two.

The said broken line begins at point A, and thence runs south-westerly three hundred and sixty-one and twenty-five one-hundredths (361.25) feet to point B; then turns and runs more westerly six hundred and forty-nine and thirteen one-hundredths (649.13) feet to point C; then turns and runs more westerly six hundred and fourteen and forty-five one-hundredths (614.45) feet to point D; then turns and runs more westerly three hundred and forty-three and two one-hundredths (343.02) feet to point E; then turns and runs more southerly four hundred and twenty-five and six one-hundredths (425.06) feet to said point F; then turns and runs more westerly nine hundred and ninety-nine and thirty one-hundredths (999.30) feet to point G; and it is further decreed that no costs be taxed in this cause.

By the Court,

THEODORE M. OSBORNE,

Assistant Clerk.

APRIL 10, 1896.

Assented to, GEORGE A. BLANEY,

Of Counsel for Benj. F. Brown.

Copy. Attest.

JOS. A. WILLARD,

Clerk.

[G.]

[See page 33 of this report, *ante*.]

SPECIFICATIONS FOR REMOVING WRECK IN
CHELSEA CREEK.

Boston, Aug. 13, 1896.

The contractor is to furnish at his own cost and expense all the plant, apparatus, materials and labor necessary to break up and remove from tide water and to place on the shore above high-water mark at some place or places to be approved by the Board of Harbor and Land Commissioners, all and every part of the remains of an old vessel, supposed to be the hull of the schooner "Mary C.," now lying sunken and abandoned in the tide waters of Chelsea Creek, between Chelsea Street bridge and the bridge of the Grand Junction branch of the Boston & Albany Railroad.

The wreck to be first removed to some point to be approved by the Board of Harbor and Land Commissioners, and then broken up. After breaking it up, all the material now composing the wreck is to be removed and placed on the shore above high-water mark and none is to be allowed to remain in tide water at any place.

All the work to be subject to the approval and direction of the engineer of the Board of Harbor and Land Commissioners, and to the satisfaction of said Board.

The work of removal shall be begun in season to have it completed at the time specified, and it shall be completed on or before December 1, 1896. The contractor shall save the Commonwealth harmless from all liability for damages to any person or property caused by or in any way arising from the carrying out of the work.

The work to be paid for upon its completion and acceptance.

Bids are required to be in a gross sum for the whole work, and the right is expressly reserved to reject any and all bids.

Sealed proposals for the above work will be received by said Board at its office, 65 Bowdoin Street, Boston, Mass., up to Tuesday, Aug. 18, 1896, at 12 o'clock noon. They are to be endorsed "Proposals for removing wreck in Chelsea Creek."

Proposal.

The undersigned hereby agrees with the Commonwealth of Massachusetts, acting by its Board of Harbor and Land Commissioners, and subject to the approval of its Governor and Council, to furnish all the plant, apparatus, materials and labor, and to do, furnish, perform and complete all other things provided for in the foregoing specifications, subject to the terms and conditions therein set forth, for the price or sum of two hundred and ten (210) dollars, the same to be in full compensation for all the work and other things done, furnished, performed and completed as aforesaid.

W. H. WYMAN.

The foregoing proposal of W. H. Wyman being the lowest bid received is hereby accepted by the Board of Harbor and Land Commissioners this eighteenth day of August, 1896.

WOODWARD EMERY.
JOHN I. BAKER.

Approved in Council. Aug. 27, 1896.

E. F. HAMLIN,
Executive Clerk.

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HEMLOCK GORGE RESERVATION,
RUSTIC BRIDGE.



REPORT

OF THE

Board of Metropolitan Park

Commissioners.

JANUARY, 1897.

BOSTON :
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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1897.

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Commonwealth of Massachusetts.

REPORT.

The Metropolitan Park Commission presents herewith its fourth annual report.

The work of this Commission, and especially the matters to be presented in this report, cannot be fully understood without some knowledge of its previous reports and of the legislation under which it has acted. It will be a manifest convenience, therefore, to briefly review both at the outset of this report.

The subject of a Metropolitan Park System was discussed and the general plan outlined in a report made Jan. 1, 1893, by a preliminary commission, appointed to consider the advisability of laying out ample open spaces in the vicinity of Boston. That report pointed out the Metropolitan community of life and interests in the cities and towns for twelve miles about Boston, enumerated the dominant features of this Metropolitan area in the order of their importance, and suggested a method of securing and holding them as open spaces for exercise and recreation. As a result, the Metropolitan Park Act, chapter 407, Acts of 1893, was passed, and this Board appointed, with adequate powers to carry out its provisions in a Metropolitan District of thirty-seven cities and towns. An appropriation of \$1,000,000 was at the same time provided by a loan from the Commonwealth on its forty-year bonds, to be repaid by yearly assessments upon the district, according to a rate to be determined each five years by a separate commission to be appointed by the supreme court. The yearly expense

of care and maintenance was to be assessed at the same rate. Various minor acts have since been passed, to enable the Board to carry out to its full intention the trust thus created. The confidence thus reposed in this Board as well as its labors were materially increased by chapter 288 of the Acts of 1894, usually called the Boulevard Act, which empowered it to connect any public open space with any part of the district. An appropriation of \$500,000 under this act was intended to provide for a suitable approach to the Blue Hills and to the Middlesex Fells. The loan for this last appropriation is known as Metropolitan Parks Loan, Series Two, and the others have been grouped as Metropolitan Parks Loan, Series One, and Charles River Loan.

In its last report the Board described the reservations which had been acquired under the Park Acts. Blue Hills, twelve miles to the south of the State House, and Middlesex Fells, five miles to the north, were reported to have been taken as great reservations of wooded wild lands; Stony Brook, a smaller reservation, five miles to the south, had been taken to frame the picture of the Great Blue in a future parkway from Bussey Woods of the Boston Park System to the Blue Hills; Hemlock Gorge, on the upper Charles, and Beaver Brook, to the north-west, — the latter celebrated for its great oaks and its brook famous in Lowell's poem, — had been taken as spots of rarest beauty and interest. About all the banks of Charles River to Watertown not already in other public ownership, and three miles of Revere Beach to the north-east, had also been acquired as the best selections of river-bank and sea-shore within the Metropolitan District. Land to form part of the West Roxbury Parkway from Bussey Woods to Stony Brook Woods had also been taken, and transferred to the city of Boston for care and development; while the tiny quarter mile of King's Beach, at the extreme north-east corner of the district, which had been taken to encourage Swampscott to acquire its neighboring Blaney Beach, was soon to be transferred to that town to care for at its own expense. Within the larger woods reservations, it was also reported, the dead trees and underbrush had been largely cleared away, and a considerable number of preliminary roads and paths built on the

line of former cart paths, and opened at once to the public. Even this development was more than had been at first contemplated, but had been found necessary to prevent fires, and to satisfy the plainly manifested desire of the public to make immediate use of the reservations. The smaller woods reservations had been merely cleared of rubbish and the more important trees cared for. On Charles River no development had been provided for or undertaken. At Revere Beach no development had been possible, because of the magnitude of the preliminary problems to be solved, but progress in the solution of these problems was reported.

Under the Boulevard Act the Board at the same time reported that a plan had been adopted to provide on the south a broad and easy road or parkway between the Blue Hills and Mattapan Square, where connection would be made with the Boston Park System through Blue Hill Avenue to Franklin Park, and on the north a similar parkway between Bears' Den and Pine Hill, the two southernmost points of the Middlesex Fells, and Broadway Park, Somerville, which lies on the outer edge of the dense population, two and one-half miles from the State House. Land had been acquired for portions of the latter in Malden and Medford, and construction begun. Land had also been acquired, mostly by gift, for an additional parkway along Mystic Lakes and Abbajona River from West Medford to Winchester close by the Fells, and construction of a driveway begun.

These latter takings and construction and the lands to be taken for Blue Hills Parkway were then estimated to require the entire appropriation under the Boulevard Act. Detailed reasons were given to explain the necessity for an additional appropriation of \$500,000 to complete the work already undertaken under the Park Acts. No appropriations for new work were asked for under either act, because it was felt that, although a larger part of the entire plan outlined in the report of the preliminary commission had been carried out than was supposed possible under the appropriations first made, none the less a fuller understanding of the whole matter made it seem right to pause and ask the Legislature to determine the course to be thereafter pursued. The

Board therefore contented itself with mere suggestions as to the possibility and proper scope of future work.

During the winter of 1896 petitions and bills were presented to the Legislature from various parts of the district, asking that this Board be authorized and even commanded to continue its work, and that adequate appropriations be made for such purpose. Some of these petitions asked that the appropriations be limited to specific reservations or pieces of work. The Board attended more than a dozen hearings, but was unwilling to express any opinions as to their merits not already expressed in its reports, unless further opportunity was afforded for detailed study. Finally, however, at the request of the committee having these matters in hand, the Commission with its landscape advisers reviewed the plan outlined by the preliminary commission, and indicated the portions which had been carried out and the additional reservations which it would be advisable to secure at once, if an appropriation of \$500,000 should be made under the Park Acts in addition to that required for work in hand. As most of the petitions had been presented under the Boulevard Act, the Board stated in regard to them that the only work under that act which it could wisely undertake would be such as was designed to make the reservations acquired under the Park Acts more available, and as part of a complete plan to unite these reservations into a Metropolitan System. Such a general plan, providing for present acquirement of lands and limited construction to cost \$1,000,000, was outlined. As a result of these hearings and of the report made by the committee, a general appropriation of \$1,000,000 was made by the Legislature under the Park Acts by chapter 466 of the Acts of 1896; and an appropriation, reduced from the estimate of the Commission to \$500,000, was made under the Boulevard Act, by chapter 472 of the Acts of 1896.

The total appropriations thus far made to the use of this Board are, therefore, under the Park Acts \$3,000,000, under Charles River Act \$300,000, and under the Boulevard Acts \$1,000,000.

The conditions of these appropriations Dec. 1, 1896, is shown by the following statement :—

Metropolitan Parks Loan, Series I.

Total of loans,		\$3,000,000 00
Expended to Dec. 1, 1896,	\$1,963,225 02	
Sinking fund requirements to 1896,	18,980 18	
Care and maintenance to July 1, 1896,	85,813 46	
	<hr/>	
	\$2,068,018 66	
Amount retained by treasurer to cover further charges:—		
Sinking fund, 1897, 1898 and 1899,	151,184 16	
Interest,	375,551 88	
Balance of \$40,000 appropriation for expenses of 1896,	22,337 26	
	<hr/>	
		2,617,091 96
Amount available on Parks Loan,		<hr/>
		\$382,908 04

Metropolitan Parks Loan, Series II.

Total of loans,		\$1,000,000 00
Expended to Dec. 1, 1896,	\$307,769 94	
Sinking fund requirements to 1896,	3,650 03	
	<hr/>	
	\$311,419 97	
Amount retained by treasurer to cover further charges:—		
Sinking fund, 1897, 1898 and 1899,	22,906 68	
Interest,	61,250 00	
	<hr/>	
		395,576 65
Amount available on Parks Loan, Series Two,		<hr/>
		\$604,423 35
Charles River Loan,		\$300,000 00
Expended to Dec. 1, 1896,		150,508 76
		<hr/>
Amount available on Charles River Loan,		\$149,491 24

In this statement certain charges for sinking fund, interest and maintenance, amounting to \$741,673.65, will be noted. These require explanation. Subsequent to the appropriation made in 1896, an act (chapter 550 of the Acts of 1896) was passed which set aside the apportionment already made as a basis for repayment of these appropriations by the District to the Commonwealth, provided for a new apportionment in 1900, and directed that the interest and sinking fund requirements and all expenses for care and maintenance should be paid out of the principal of the loans already made. The same act also directed this Commission to complete all its work of construction and acquirement before that date.

The situation created by this act was embarrassing. On

the one hand, the Board was authorized to make new takings to the extent of considerable appropriations; and, on the other, these appropriations were withdrawn to other uses. Its actual financial ability was less than if the Legislature had been content to make appropriations only to the amount necessary to complete the work actually in hand. The Board certainly had no reason to feel that this act meant a disapproval of its work and plans, and yet the completion of the work already undertaken was threatened. Under these circumstances it was decided to curtail expenses; to make no new takings except such as could certainly be paid for by the appropriations, after allowing for the requirements of the new act of apportionment; to confine the work of the remainder of the year to work already in hand and minor details of management and development, to settlement for lands taken and to investigation and accumulation of data for possible new work.

The reservations acquired under the Park Acts remain, therefore, practically the same as last year. In the Middlesex Fells 166 acres have been taken which had been previously omitted, at the request of the city of Medford, in the idea, formed before the Metropolitan Water System was provided for, that they would be needed as a part of the water system of that city. An entrance has been taken to the Stony Brook Reservation from Gordon Avenue, Hyde Park, and other slight takings and abandonments have been made, either for scenery or the improvement of boundaries, or to facilitate settlements with adjoining owners. The area of the reservations now in the care of the Commission are as follows:—

	Acres.
Blue Hills,	4,189.69
Middlesex Fells,	1,799.60
Stony Brook,	460.64
Charles River,	188.88
Beaver Brook,	58.08
Hemlock Gorge,	24.68
Revere Beach,	63.29
Total,	<hr/> 6,784.86

In this list West Roxbury Parkway, previously transferred to the city of Boston, and King's Beach, to be transferred to

BLUE HILLS PARKWAY.
NEPONSET RIVER FROM MATTAPAN SQUARE

the town of Swampscott, are not included. In the Middlesex Fells the holdings of the water boards, amounting to about 1,200 acres, are in the care of the Commission, although not formally transferred.

Two important takings, however, have been made this year under the Boulevard Acts, which have showed a safe balance of appropriations. The first, in April last, was of lands and existing streets for the Blue Hills Parkway from Mattapan Square to the Harland Street entrance to the Blue Hills; the second, in November, was of lands from Broadway Park, Somerville, to Pleasant Street, Malden, and Salem Street, Medford, for the completion of the parkway to Middlesex Fells. These, with the Mystic Valley Parkway, make a total length of 8.97 miles.

Two important gifts of land have been received the past year. The first was of land in connection with the Mystic Valley Parkway, from the Francis Brooks real estate trust and Mr. Peter C. Brooks; the second was of land for about one-half of a mile along the northerly side of the Neponset River from Mattapan Square towards Hyde Park. The shore opposite has also been given to the town of Milton.

In addition, a sum of about \$1,000 has been given by Miss Ellen Wright and others, to be used in the discretion of the Commission either in tree planting or to erect an outlook on Pine Hill, Medford. It is probable that the Board will prefer the outlook, and will make it in some degree a memorial to Elizur Wright, whose life was so largely devoted to initiating the movement to secure these reservations.

The management of the-reservations has been revised and improved. In the woods reservations the preliminary development of clearing and road building is practically done. The office of general superintendent is now unnecessary, and each reservation in which work is being done is in charge of a resident superintendent, who is responsible directly to the Commission through its executive officer, the secretary. The police have been uniformed, and so far as possible required to live upon the reservations in houses belonging to the Commonwealth. The other em-

ployees have been reduced to the basis of a permanent force required for care in the present stage of development. In the Blue Hills only bridle paths have been built, chiefly as fireguards. In the Fells one short connecting road has been built, and about a mile of boundary road; and some of the roads widened to meet the needs of the constantly increasing use of the reservation. Revere Beach has received the most attention. An efficient police force was organized early in the season, and has been very successful in aiding and controlling the crowds, sometimes of 40,000 in a single day. The buildings between the railroad and water which were leased during the summer have since been removed, with the exception of the few required for administration purposes. Satisfactory contracts have been made with the railroads to move to new locations and abolish grade crossings before May, 1897, and construction is well under way. Under the Boulevard Act construction of the easterly branch of Fellsway has been completed from Pleasant Street, Malden, to Bears' Den, and has become the principal entrance to the easterly side of the Fells. The Mystic Valley Driveway has been completed to sub-grade, and will probably be finished before next summer. In the Blue Hills Parkway the existing roads have been repaired, and now furnish ample accommodation, except between Mattapan Square and Brook Road. It is hoped to construct this portion to its full width with double roadway next year.

Looking to the future, the line of duty seems very plain. The work in which this Commission is engaged is that of the Commonwealth and the District, not its own. It is three-fold, including, first, the care of the reservations and parkways already acquired; next, the new work of development and acquirement; and lastly, investigation and study of those portions of the plan outlined by the preliminary commission not yet reported on in detail, and of other problems especially assigned to it. Every effort is made to conduct this work in all its branches discreetly, economically and rapidly. The service of the Commission is rendered freely, but none the less with devotion to the work, and is a considerable draft upon the time and strength of

its members. The reservations already acquired and work already done represent a distinct addition to the material resources of the Commonwealth. Considered merely as salable assets, they are worth more than they have cost, and in addition they have a present material value, in that they make every bond of the Commonwealth bear a lower rate of interest. The value of such an investment ought to be preserved and increased and handed on at its best. But they have a higher value in the renown they bring to the Commonwealth and in the health and pleasure they give to the public. It is apparent that there is a constantly increasing use of the reservations and a demand for new development and additional acquirements.

In the face of these facts, the Board is a conservative factor in asking that appropriations be made in general form and with continuing certainty, yet not so rapidly nor so great in amount as to preclude deliberate action and necessary study of details. For the coming year it is of the first importance that the large withdrawal of available funds made during the past year be provided for either by some new appropriation for the requirements of the sinking fund and for care and maintenance until 1900, or by an additional appropriation made directly to the use of the Commission. In this way only can the Commonwealth meet the obligations which it has authorized, and properly preserve and make use of the property which it has intrusted to the care of this Commission.

So much, then, for the work that must be done. In addition, there remain opportunities and duties which impress themselves most strongly on any one who studies the Metropolitan District as this Board has done for several years. The dominant physical features of the district are its wild lands, rivers and sea-shore. When the Board began its work, the most interesting large areas of wild lands not already preserved were the Blue Hills and Middlesex Fells. They were in immediate danger of destruction, and were therefore the first care of the Board. It does not seem wise to acquire any other large reservations of this class, although the care of the Lynn Woods (2,000 acres), which was acquired by the city of Lynn in advance of the work of this Board, might properly be undertaken, and small takings

made to round out its boundaries and provide convenient approaches.

Of the sea-shore of the district the best "open space for exercise and recreation" has been secured in Revere Beach. Unsurpassed in beauty, it is only five miles from the State House and one mile from Lynn, and is accessible to all populous parts of the district by steam or electric cars, and low fares. The argument for additional acquirements is very strong, however. The sea-shore always has a charm and refreshment, and at certain seasons of the year becomes the great breathing space to which the fevered community rushes. Then countless lives may be saved by its mere accessibility. The available sea-shore of the district is limited, and is being shut out from the public for private pleasure and profit more and more each year. There remain, however, three miles at Winthrop and six miles on Quincy Bay, which may now be secured at little more than the nominal cost of building a road between the ocean and the private land beyond. This opportunity ought at once to be embraced, or it will soon be lost.

The rivers of the district are three, — the Charles, the Mystic and the Neponset. They are at once the air-ducts and unfortunately the drainage canals of the district. Within a lifetime their waters were clear as crystal and their shores almost unscarred. To-day they are muddy, and their beauty obscured by miserable buildings drawn to their shores by the cheapness of the land. It has already cost large sums to prevent their pollution by sewerage, and yet each inflowing tide brings filth from the harbor. Of these rivers, the Charles is most important and beautiful. It flows between Boston and Cambridge, and cuts the entire district in two. In many ways it has become the greatest pleasure resort of the district, although its resources are so little available. At Riverside, ten miles out, where the river is most beautiful, thousands of canoes and boats make on a pleasant summer holiday a scene that rivals the world-known one of the English Thames. Once Charles River was just as beautiful down to the heart of the city, and it may again become equally beautiful and far more useful to the ever-increasing population. Within the cities of Cam-

bridge and Boston the shores belong to the municipalities, and the time and plan of development is to be determined in large measure by them. Most of the remaining shores to Watertown public landing have been acquired, however, by this Board, and the District and the Commonwealth have an interest in them. With such different ownerships and varying interests, either the entire shores already acquired ought to be placed in charge of a single Board, or, what is more practicable, a general plan ought to be adopted, according to which development may proceed harmoniously but at the convenience of the various controlling Boards. Such a plan was recommended in 1894 by a Joint Board of the State Board of Health and this Commission, of which the essential features were the location of future bridges and of a dam and lock for economy in development, and to make the river always navigable by keeping its level at grade 8, just below the level of the marshes. Practical problems of bridges, embankments and boundary streets must be decided in the immediate future, and the adoption of this plan and the location of a dam either near Craigie Bridge or Cottage Farm may save mistaken expenditure, to correct which in the future will cost vast sums. The same Joint Board also reported last year a plan for protecting the Upper Charles from Watertown to Dedham by acquiring occasional public landings, and upon the remaining shores an easement against nuisances and destruction of trees; by restricting the withdrawal of water below a fixed level; and by establishing a river police.

There are many other possible acquirements which would preserve the dignity and beauty of the district, and serve more or less the general needs; but the one problem of surpassing importance to the Metropolitan District is that of Charles River, and the Board therefore recommends that the locations for a dam at either Craigie Bridge or Cottage Farm and of future bridges as far as Brighton be now determined upon, and that appropriations be made to warrant the carrying out of the plan suggested by the Joint Board for the protection of the river from Watertown to Dedham.

Under the Boulevard Act, practical approaches for all classes of travel have been provided to the great woods

reservations on the north and on the south. Along Mystic Lakes a reservation has been acquired and a drive constructed which may be extended to Fresh Pond and Charles River. These are examples of what may be done to construct safe approaches to all the reservations, and to unite them into a Metropolitan System. The directions which such parkways should take will never be clearer, and land and materials can now be had at prices which in a few years will seem incredible. The entire system can be completed rapidly, and at a cost lower than ever again. It must, however, be always remembered that this Commission was appointed to secure open spaces for exercise and recreation, and that it is primarily a Park Commission. It may therefore enter upon this line of work only so far as it is in subordination to the former idea of a park system made up of reservations and parkways of distinctly Metropolitan importance. Even then the added labor and responsibility to this Commission will be very great, and important changes in method and administration may become necessary. But, on the whole, the important question to be settled is whether the district is willing to enter into the necessary expense. That question can be decided only by hearings before the Legislature; and therefore this Board, having stated the case, and through the report of its Landscape Architects and Engineer indicated the plan to be pursued and the probable rate of expense, can make no further recommendation than that the matter be so considered and decided.

The usual accompanying reports of the Secretary and Landscape Architect, and, for the first time, the report of the Engineer, are transmitted herewith.

Respectfully submitted,

WILLIAM B. DE LAS CASAS.
ABRAHAM L. RICHARDS.
AUGUSTUS HEMENWAY.
EDWIN B. HASKELL.
EDWIN U. CURTIS.

DEC. 15, 1896.

REPORT OF THE SECRETARY.

MR. WILLIAM B. DE LAS CASAS,

Chairman Metropolitan Park Commission.

SIR :—I herewith present my report for the year ending Dec. 1, 1896.

Under the Boulevard Act, so called (chapter 288 of the Acts of 1894), two important takings of lands have been made this year by the Commission. In April last lands were taken in Milton from the Neponset River at Mattapan Square to the Harland Street entrance to the Blue Hills Reservation for the proposed Blue Hills Parkway. In November lands were taken from Broadway Park in Somerville to Pleasant Street in Malden and Salem Street in Medford for the completion of the Middlesex Fells Parkway. The earlier taking, by its connection with Blue Hill Avenue at Mattapan Square, provides for a broad avenue from Franklin Park of the Boston Park System to the Blue Hills Reservation, the southernmost reservation of the Metropolitan Park System. The later taking, which will be known as Fellsway, connects at Pleasant Street with Fellsway East, and at Salem Street with Fellsway West, thus providing an approach from a park two and a half miles north of the State House to the eastern and western sections of the Middlesex Fells, the most northerly of the reservations of the Metropolitan System.

At the date of the last report lands had already been taken from Weir Bridge in West Medford along the banks of the Mystic Lakes and the Abbajona River to Winchester for the Mystic Valley Parkway. These lands have been added to by two gifts, one from the Francis Brooks real estate trust of lands in Medford, another from Mr. Peter C. Brooks of a parcel of land in Winchester on the western shore of the Upper Mystic Lake, through which once passed the line of the Middlesex Canal. The latter parcel offers an oppor-

tunity to connect the Parkway, if it is desired, with the highways on the westerly side of these lakes. One small abandonment has been made by a change in the alignment of the driveway at its junction with the northerly line of Bacon Street in Winchester.

Two slight changes have been made in the boundaries of Fellsway East, one by a taking at the junction of Sawyer Street and Highland Avenue, the other by a small abandonment at the entrance of Maple Street into the Parkway, both of which simplified problems of construction.

The lengths of these parkways are as follows :—

Blue Hills Parkway,	Miles. 2.25
Middlesex Fells Parkway :—	
Fellsway,	Miles. 2.18
Fellsway East,	1.10
Fellsway West,	1.04
	— 4.32
Mystic Valley Parkway,	2.40
	—
Total,	8.97

Under the Park Act (chapter 407 of the Acts of 1893) no lands have been taken this year by the Commission for the creation of a new reservation. The Metropolitan Park Reservations remain, therefore, seven in number; namely, the Blue Hills, Middlesex Fells, Stony Brook, Charles River, Beaver Brook, Hemlock Gorge and Revere Beach. This does not include the West Roxbury Parkway, which has been transferred to the city of Boston, nor King's Beach, which is to be transferred to the town of Swampscott. A number of takings and abandonments, however, have been made which have changed the boundaries of the several reservations affected. In the Middlesex Fells Reservation, west of Forest Street in Medford, there existed in private ownership a tract of woodland of about one hundred and sixty-six acres, bounded on three sides by the Middlesex Fells Reservation and on the remaining side by the water works reservation of the city of Medford. This island of private ownership was not included in the original takings of this Commission, on account of the expressed intention of the city of Medford to acquire these lands as an addition

to its other water-supply holdings. Subsequent events, however, having led that city to abandon its original plan, it became necessary for this Commission to take these lands to preserve the integrity of the Middlesex Fells as a public reservation, and this was done in April of this year. Other changes have been made in the boundaries of the Fells Reservation by six deeds of abandonment to the owners of abutting properties, the intention being in each case to substantially lessen existing claims against the Commonwealth so far as it could be done without material damage to the beauty or usefulness of the reservation.

The completion of the topographical survey of the Stony Brook Reservation has enabled the Landscape Architects to suggest improvements in the eastern and western boundary lines of this reservation throughout their entire lengths, from Washington Street in Boston to the town of Hyde Park. By a series of takings and abandonments of small strips of land new boundary lines have been established, along which ultimately boundary roads can be built. As a part of the same scheme, additional land has been taken to provide for a convenient entrance to the reservation from Gordon Avenue in the town of Hyde Park.

On the Charles River one taking and one abandonment have been made. About an acre of land has been acquired near the public landing in Watertown, which will make possible a better development of the reservation than the somewhat restricted taking at this point permitted. The abandonment was of less than an acre of land adjoining the Abbatoir property in Brighton, and was made for the purpose of settling a disputed boundary.

In the Beaver Brook Reservation the northern boundary has been amended, in accordance with an agreement made with the abutting owner at the time of settlement. Slight changes have been made in the boundary line along Mill Street in Belmont to make it conform to the laying out of this street on lines established by the Middlesex county commissioners.

There has been added to the Hemlock Gorge Reservation a small tract of unoccupied land on the Newton side of the Charles River, which seemed a desirable accession to the

reservation, as ensuring the preservation of the river banks at this point from any offensive use, and as also providing another convenient mode of approach to the reservation. For similar reasons it was deemed desirable to add to the King's Beach Reservation a small piece of adjoining unoccupied land.

In the Revere Beach Reservation the original intention of taking the beach in front of the Point of Pines Hotel has been abandoned. It would seem that this portion of the beach is not essential to the plan for this reservation, and that its abandonment will not only lessen the cost of the scheme, but will also leave the remaining property in better condition for development.

The area of these various reservations now stands as follows : —

	Acres.
Blue Hills,	4,189.69
Middlesex Fells,*	1,799.60
Stony Brook,	460.64
Charles River,	188.88
Beaver Brook,	58.08
Hemlock Gorge,	24.68
Revere Beach,	63.29
Total,	<u>6,784.86</u>

A gift has been accepted by the Commission of a portion of the west bank of the Neponset River, lying partly in Hyde Park and partly in Mattapan, just south of the point of beginning of the Blue Hills Parkway. This strip of land is about fifty feet in width and half a mile in length, and is transferred to the Commonwealth by the owners in the belief that the placing of the river bank in public hands, and the development of their adjoining lands with relation thereto, will be an advantage both to them and to the public. A portion of the east bank of the river directly opposite this land has already been given to the town of Milton for park purposes.

A gift of about one thousand dollars has also been accepted by the Commission from Miss Ellen M. Wright and

* This is exclusive of the holdings of the local water boards, which amount to about 1,200 acres, and are at present under the care and control of the Metropolitan Park Commission under agreements with these boards.

BEAVER BROOK RESERVATION.
THE LOWER DAM.

others, to be used in the erection of some suitable place of observation on the summit of Pine Hill, Medford, in the Middlesex Fells Reservation. It is the intention of the Commission that the result shall in some suitable manner commemorate Elizur Wright, whose name is so indissolubly connected with the securing of the Fells as a public reservation.

The past year has seen a marked increase in the use of the reservations by the public. In the Blue Hills every pleasant day large numbers of people have ascended Great Blue Hill for the extensive and varied view from the summit. Simple provisions for the checking of bicycles were provided at the foot of the hill during a portion of the year. At Hoosic-whisick Pond tables and seats suitable for picnic purposes were built at several convenient spots. A few boats were put in charge of an officer stationed here, who also had oversight of the two bath-houses on the edge of the pond. These somewhat primitive arrangements for visitors have been used to their full capacity. The roads and bridle paths in the Middlesex Fells are hardly adequate to the amount of travel by carriage and bicycle which the attraction of the scenery brings thither. An illustration of this occurred in a block of over thirty carriages, which happened one day this summer on one of the wood roads, caused by a slight carriage accident at a narrow point in the road. In the winter months the ponds at Stony Brook and Beaver Brook have furnished opportunities for skating to many thousands. From actual count it is known that the ponds at the latter reservation in one week of January last were used by at least three thousand skaters. As many as fifteen hundred people have passed over Echo Bridge in a day to look upon the lovely scenery of Hemlock Gorge. During the summer these two smaller reservations have been visited by large numbers of picnickers, driving parties, bicyclers, botanists, artists and photographers, who have discovered the beauty and interest of these charming spots.

It seems clear that the Commission will be forced to proceed more quickly with the development of its reservations than was originally intended. Nowhere has this been made more apparent than at Revere Beach. It became necessary

in the spring to make some temporary arrangements for the administration of this reservation until the tracks of the Boston, Revere Beach & Lynn Railroad should be removed therefrom. For many reasons it seemed inexpedient to tear down at once the buildings standing between the railroad and the sea, not the least of which was the necessity of providing in some manner for the accommodation of visitors to the beach during the summer months. Therefore the buildings were leased, largely to the former owners, on terms which it was thought would ensure good order. Rules and regulations for the government and use of the reservation were adopted, and the beach placed in the charge of a superintendent and a competent force of police. As a result, the beach was visited by a great number of people, and more largely than ever before by women and children. Good order was maintained, and the absence of any rough element was remarkable. In one week in August it is estimated that the reservation was visited by two hundred thousand people, during which time not a single arrest occurred. It is evident that preparations must be made at once in this reservation for its general use by the public.

The general plan of administration by departments responsible through the Secretary to the Commission has been continued.

The Landscape Architects' report of what they have done and suggested during the year will be found appended.

The work of the Engineering Department has become of so much importance, both in extent and in character, that I have requested the engineer to submit a separate report, which I present herewith. Under his supervision the construction of Fellsway East, which was begun in the fall of 1895, was completed about October 1 of this year. This portion of the Middlesex Fells Parkway is about one mile in length, and extends from Pleasant Street in Malden to the Bears' Den entrance of the Middlesex Fells Reservation. Except where it passes through Fellsmere Park, the property of the city of Malden, it consists of a double driveway, with sidewalks and planting spaces and an electric car reservation in the centre. Although it will not come into full use until the completion of Fellsway, it is already used by a

large number of people in going to and from the east section of the Fells.

The engineer is also in charge of the construction going on in the Mystic Valley Parkway. The driveway from High Street in Medford to Walnut Street in Winchester has been finished to sub-grade. Contracts for building the walks and grading the surface of the parkway outside the driveway have been made, and the work, which has already begun, will be carried on during the winter. It is expected that the driveway will be in condition for surfacing in the early part of the coming summer. Where it crosses the Abbajona River at the head of the Upper Mystic Lake an iron bridge on stone abutments has been built.

Other construction in charge of the engineer has been the building of a short piece of border road along the boundary of the Fells from Bears' Den to Highland Avenue in Medford, near the junction of Elm Street, and the rebuilding of an insecure dam in the Hemlock Gorge Reservation.

In addition to the supervision of the above work, which has been done by contract, the Engineering Department has furnished the necessary data for such road building, grading and like work as has been done by the regular forces in the reservations. During the year an unusually large number of surveys and plans for various purposes, such as takings, abandonments, construction, settlement of claims, search of titles, trial of causes, and for purposes of study by the Commission, has been prepared by this department.

The Claim Department has been placed in charge of George Lyman Rogers, Esq., a member of the Suffolk Bar. Settlements for lands taken have progressed with considerable rapidity, and on the whole on terms which it is believed have been fair both to the owner and the Commonwealth. The policy has been continued of using every reasonable effort to obtain a settlement without litigation, in the belief that such a course is due to the owner of land taken by right of eminent domain as well as of advantage to the State. Over one hundred claims have been disposed of during the year by agreements made directly with the Commission. In many cases where petitions have been brought by dissatisfied claimants settlements have subse-

quently been effected in the Attorney-General's department without trial. Six cases have been tried, and except in one case the amount recovered has not been much in excess of what the Commission considered the fair value of the property.

In the spring of this year a simplification was made in the method of administration of the reservations. During the winter the work of clearing the woods of dangerously inflammable material was continued, and, except in some of the less frequented and therefore less exposed portions of the Blue Hills, was completed in all the reservations by the first of May. A large force of laborers was no longer required, and the office of General Superintendent was therefore abolished. Each reservation was placed in the charge of the local superintendent, who was made directly responsible through the Secretary to the Commission for the conduct of his reservation. He is required to live on the reservation in a house provided for him by the Commission, and acts also as chief of police. Once a week the superintendents meet the Secretary at the office of the Commission, receive the week's pay roll, report on the work done and consult him as to future work. In the larger wooded reservations a small force of laborers has been retained, and with these the superintendents are expected to keep the roads in repair, to protect the reservations against fire and to carry on gradually such work of construction and improvement as can be undertaken with a small force. In the small reservations labor has been employed only as exigency required.

The system adopted is simple, and has proved both satisfactory and economical. The roads have been kept in excellent condition, and in many places improved both as to safety and appearance. No fire of any consequence has occurred. In the Blue Hills the administration road, which runs the entire length of the reservation, has been materially improved by the sloping of banks, and about eleven miles of the old wood roads and paths have been cleared and made passable. This bridle-path work, as it may be termed, serves the double purpose of making the reservation more accessible and at the same time of providing fireguards, by means of which it is possible to confine a fire within a

BLUE HILLS RESERVATION.
A BRIDLE PATH.



restricted area. The importance of this work can perhaps be realized only by those who have seen how rapidly nature is clothing these beautiful but fire-ravaged hills with a new growth of green woods. Similar work has been done in the Middlesex Fells, and a short piece of road about an eighth of a mile in length has been built to provide a much-needed connection for roads already constructed. The offices of this reservation have been removed from the site of the old Red Mills in Wyoming to a more convenient situation at the head of Spot Pond in Stoneham.

In the Stony Brook Reservation the new boundary line has been cut out as a fireguard, the temporary road through the reservation somewhat improved, a short piece of road constructed to the Summit, a simple rustic bath-house for boys built on the shores of Turtle Pond, all buildings removed except those retained for administration, and the cellar holes graded over.

In the Beaver Brook Reservation the dams of the ponds have been strengthened and considerable grading done. The trees have been protected and cared for and the notable ones suitably labelled.

In the Hemlock Gorge Reservation the old mill buildings on Boylston Street have been torn down and the raceway replaced by a substantial dam. All the houses on the Ellis Street side have been removed, except the one nearest Echo Bridge, which is being altered for use by the superintendent. Paths and rustic bridges have been built in the grove, and what was formally a dancing pavilion has been put in condition to serve as a shelter.

In the Revere Beach Reservation a work of considerable magnitude is being pushed with great vigor; namely, the removal of the Boston, Revere Beach & Lynn Railroad from its present location on the ridge of the beach. In July last an agreement was reached between the Commission and the railroad company, by which the railroad company agreed to construct, upon a new location outside of the reservation, to be provided by the Commonwealth, a new road-bed, and to remove its tracks from the reservation with all possible speed. Steps were immediately taken for obtaining the new location and for providing for separation of grade crossings,

changes in streets, sewers, water pipes and electric railroads, and also for the relocation of a portion of the Boston & Maine Railroad between Crescent Beach and the Point of Pines, which was affected by these changes. These preliminaries have all been arranged and the work of constructing the new line is well advanced. It is expected that the railroad will be running on its new location by May 1 of next year, until which time the development of the ridge of the beach must necessarily be postponed. In the meanwhile, however, eighty buildings standing between the railroad and the sea, not required for purposes of administration, have been removed or torn down, a sanitary has been erected, and quarters provided for the superintendent and police. Surveys and borings have been made, and studies for the permanent development of the reservation are under consideration.

I have prepared and present with this report the usual annual financial statement of the expenditures of this Commission. The items relating to charges for interest and sinking fund requirements, and cost of maintenance and operation, require a word of explanation. The act creating the Metropolitan Park Commission, and all subsequent acts authorizing the expenditures of moneys by it, provide, in substance, that the first cost of the reservations and parkways and the expenses of maintaining the same shall be paid out of the State treasury from the proceeds of bonds issued on the credit of the Commonwealth. To meet the sinking fund and interest requirements on these bonds, and the expenses for the maintenance of the Metropolitan Park System, provision was made for an annual tax levy on the cities and towns of the Metropolitan Park District, the proportion to be paid by each city and town to be fixed for each period of five years thereafter, in accordance with an award of a special commission to be appointed by the Supreme Judicial Court. At the date of the last report a commission had already been appointed for fixing this proportion for the first period of five years, and their report, after several hearings thereon, was accepted by the court in April of the present year. Subsequently, on June 9, 1896, by an act of the Legislature (chapter 550 of the Acts of 1896), this award was set aside,

and any apportionment of the cost of the Metropolitan Park System among the cities and towns of the district was postponed until Jan. 1, 1900. The same act provided that the Treasurer of the Commonwealth should not only charge to the loans already authorized the sums required to meet sinking fund and interest requirements and expenses of the Commission to Jan. 1, 1896, but should continue to charge these items to the loans until Jan. 1, 1900, when the first apportionment among the towns and cities of the district was to be made. In order to determine what sum of money remained available to the Commission after the passage of this act, it became necessary to determine whether it was the duty of the State Auditor to charge the amounts required for sinking fund, interest and expenses to the loan as they accrued, or whether he was required to withhold in addition thereto a sufficient sum to meet such requirements until Jan. 1, 1900. The question was submitted to the Attorney-General, and, acting upon his opinion, the Auditor notified the Commission that he should not only charge to the loans at once \$108,443.67, but should retain in his hands, to cover future requirements for sinking fund and interest charges, the sum of \$633,229.98; in other words, the amount available to the Commission for its purposes was reduced by this act \$741,673.65. The immediate effect of this act was to reduce the sum on hand for general park purposes to an amount less than it is estimated is required for meeting liabilities already incurred. Enough, however, remains available in the boulevard loan to complete the work already undertaken thereunder. The act in question and the opinion of the Attorney-General are printed as an Appendix to this report. I have also appended from the books of the State Auditor a statement more in detail of the payments made on account of the parks loans from Jan. 1 to Dec. 3, 1896.

Respectfully submitted,

JOHN WOODBURY,

Secretary.

FINANCIAL STATEMENT.

DEC. 1, 1895, TO DEC. 1, 1896.

Metropolitan Parks Loan, \$3,000,000 00

Expenditures.

Blue Hills Reservation : —

Land,	\$33,429 33	
Labor,	26,567 21	
Legal,	1,625 84	
Landscape Architects, fees,	700 00	
Landscape Architects, expenses,	138 30	
Topographical survey,	2,510 29	
Engineering,	1,176 66	
Tools, materials, etc., .	121 52	
Expenses of land set- tlements,	253 10	
Telephone line,	165 28	
Boundstones,	115 20	
Annual report,	80 97	
Miscellaneous,	47 50	
Total,	<u> </u>	\$66,931 20

Middlesex Fells Reservation : —

Land,	\$265,533 73
Labor,	20,676 53
Legal,	6,333 15
Landscape Architects, fees,	700 00
Landscape Architects, expenses,	220 41
Topographical survey,	1,742 86
Engineering,	2,499 74
Tools, materials, etc., .	211 65
Expenses of land set- tlements,	254 17
Boundstones,	487 00

<i>Am'ts carried forward,</i>	<u>\$298,659 24</u>	<u>\$66,931 20</u>	<u>\$3,000,000 00</u>
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Am'ts brought forward, \$298,659 24 \$66,931 20 \$3,000,000 00

Alterations on office buildings and super- tendent's house, . . .	1,344 23		
Annual report, . . .	177 96		
Miscellaneous, . . .	53 15		
Total, . . .	— — —	300,234 58	

Beaver Brook Reservation : —

Land,	\$2,000 00		
Labor,	1,743 78		
Legal,	112 25		
Landscape Architects, fees,	150 00		
Landscape Architects, expenses,	88 30		
Engineering,	79 71		
Repairs of North Street,	83 87		
Repairs of dam,	20 70		
Boundstones,	50 00		
Miscellaneous,	52 50		
Total,	— — —	4,381 11	

Stony Brook Reservation : —

Land,	\$97,414 33		
Labor,	3,888 97		
Legal,	3,210 49		
Landscape Architects, fees,	300 00		
Landscape Architects, expenses,	157 13		
Engineering,	2,663 46		
Expenses of land set- tlements,	569 16		
Tool house,	175 00		
Bath-house,	105 00		
Shrubs for office grounds,	70 07		
Boundstones,	84 00		
Annual report,	12 96		
Miscellaneous,	119 00		
Total,	— — —	108,769 57	

Revere Beach Reservation : —

Land,	\$233,561 09
Labor,	496 34
Legal,	2,774 52

<i>Am'ts carried forward,</i> \$236,831 95 \$480,316 46 \$3,000,000 00
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<i>Am'ts brought forward,</i>	\$236,831 95	\$480,316 46	\$3,000,000 00
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Landscape Architects, fees,	300 00		
Landscape Architects, expenses,	69 48		
Engineering,	802 20		
Engineering, outside department,	905 03		
Expenses of land set- tlements,	301 67		
Advertising rules,	385 19		
Alterations on office and superintendent's house,	2,237 61		
Sanitary,	2,636 09		
Prison cells,	470 00		
Drinking fountain,	92 69		
Repairs of bulkhead, etc.,	301 30		
Electric lights,	100 00		
Annual report,	54 00		
Miscellaneous,	88 75		
Total,	<u> </u>	245,575 96	

West Roxbury Parkway : —

Land,	\$9,364 82		
Legal,	286 95		
Expense of land set- tlements,	80 00		
Total,	<u> </u>	9,731 77	

Hemlock Gorge Reservation : —

Land,	\$16,900 00		
Labor,	1,643 35		
Legal,	477 81		
Landscape Architects, fees,	150 00		
Landscape Architects, expenses,	35 73		
Engineering,	754 48		
Rebuilding raceway dam, reservoir gate, etc.,	1,628 68		
Alteration of superin- tendent's house,	800 00		
Boundstones,	40 00		
<i>Am'ts carried forward,</i>	\$22,430 05	\$785,624 19	\$3,000,000 00

<i>Am'ts brought forward,</i>	\$22,480 05	\$735,624 19	\$3,000,000 00
Painting bridge and fence,	26 25		
Rowboat,	24 50		
Annual report,	30 00		
Miscellaneous,	41 60		
Total,	<u> </u>	22,552 40	
General expenses:—			
Legal,	\$13,061 66		
Landscape Architects, expenses,	698 69		
Engineering,	973 55		
Expenses of land set- tlements,	846 25		
Annual report,	1,095 40		
Transferred by Auditor from expense ac- count to Parks Loan,	543 53		
Miscellaneous,	20 00		
Total,	<u> </u>	17,239 08	
		<u> </u>	
		\$775,415 67	
Amount expended to Dec. 1, 1895, .		1,187,809 35	
		<u> </u>	
Amount expended to Dec. 1, 1896, .		\$1,963,225 02	
Sinking fund requirements to 1896, .		18,980 18	
Care and maintenance to July 1, 1896,		85,813 46	
		<u> </u>	
		\$2,068,018 66	
Amounts retained by Treasurer to cover future charges:—			
Sinking fund, 1897, 1898 and 1899, .		151,184 16	
Interest,		375,551 88	
Balance of \$40,000, appropriation for expenses of 1896,		22,337 26	
		<u> </u>	2,617,091 96
			<u> </u>
Amount available on Parks Loan,			\$382,908 04
Metropolitan Parks Loan, Series 2,			\$1,000,000 00
Blue Hills Boundary:—			
Labor,	\$502 73		
Total,	<u> </u>	\$502 73	
		<u> </u>	
<i>Amounts carried forward,</i>		\$502 73	\$1,000,000 00

Amounts brought forward, . . . \$502 73 \$1,000,000 00

Middlesex Fells Boundary: —

Construction, . . .	\$2,542 68	
Advertising, . . .	53 87	
Engineering, . . .	5 75	
Total, . . .	<u>2,602 30</u>	

Blue Hills Parkway: —

Labor, . . .	\$189 83	
Legal expenses, . . .	592 52	
Landscape Architects, fees, . . .	350 00	
Engineering, . . .	646 20	
Total, . . .	<u>1,778 55</u>	

Middlesex Fells Parkway: —

Land, . . .	\$3,450 00	
Labor, . . .	24 75	
Construction, . . .	69,726 91	
Legal expenses, . . .	592 35	
Landscape Architects, fees, . . .	350 00	
Landscape Architects, expenses, . . .	46 53	
Engineering, . . .	4,807 89	
Expenses of land set- tlements, . . .	150 00	
Boundstones, . . .	215 00	
Fence, . . .	75 00	
Advertising, . . .	64 81	
Miscellaneous, . . .	128 88	
Total, . . .	<u>79,632 12</u>	

Mystic Valley Parkway: —

Land, . . .	\$22,126 99	
Labor, . . .	218 40	
Construction, . . .	31,852 72	
Abbajona Bridge, . . .	10,937 12	
Legal expenses, . . .	820 62	
Landscape Architects, fees, . . .	1,300 00	
Landscape Architects, expenses, . . .	297 88	
Engineering, . . .	4,406 92	
Advertising, . . .	489 98	

<i>Am'ts carried forward,</i>	\$72,450 63	\$84,515 70	\$1,000,000 00
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<i>Am'ts brought forward,</i>	\$72,450 63	\$84,515 70	\$1,000,000 00
Boundstones, . . .	23 40		
Miscellaneous, . . .	116 49		
Total, . . .	<u> </u>	72,590 52	
General expenses:—			
Legal expenses, . . .	\$358 65		
Landscape Architects, expenses, . . .	274 78		
Engineering, . . .	1,854 82		
Engineering outside of department, . . .	200 00		
Expenses of land set- tlements, . . .	841 67		
Annual report, . . .	295 70		
Total, . . .	<u> </u>	3,825 62	
		<u> </u>	
		\$160,931 84	
Amount expended to Dec. 1, 1895, .		146,838 10	
		<u> </u>	
Amount expended to Dec. 1, 1896, .		\$307,769 94	
Sinking fund requirements to 1896, .		3,650 03	
		<u> </u>	
		\$311,419 97	
Amounts retained by Treasurer to cover future charges:—			
Sinking fund, 1897, 1898 and 1899, .		22,906 68	
Interest,		61,250 00	
		<u> </u>	
			395,576 65
Amount available on Parks Loan, Series 2, . . .			\$604,423 35
Charles River Loan,			\$300,000 00
Land,	\$138,375 00		
Legal expenses, . . .	3,543 86		
Landscape Architects, fees,	700 00		
Landscape Architects, expenses,	216 78		
Engineering,	273 08		
Annual report,	427 82		
Miscellaneous,	130 16		
Total,	<u> </u>	\$143,666 70	
Amount expended to Dec. 1, 1895, .		6,842 06	
		<u> </u>	
Total amount expended to Dec. 1, 1896,			150,508 76
Amount available on Charles River Loan,			\$149,491 24

CARE AND MAINTENANCE, DEC. 1, 1895, TO DEC. 1, 1896.

Total expenditure,	\$39,305 96
Salaries,	\$6,766 46
Police,	11,174 76
Travelling expenses,	1,565 53
Law expenses,	81 00
Maps, plans, etc.,	864 98
Rent,	1,775 04
Stationery,	1,234 34
Repairs,	668 03
Telephones,	608 84
Keep of horses,	1,739 88
Repairs of roads,	5,183 57
Watering and lighting,	416 23
Tools, materials, etc.,	2,081 76
Office fittings,	388 57
Postage, etc.,	350 97
Paints,	231 30
Signs,	174 00
Typewriters,	153 75
Horses,	944 00
Carriages, carts, etc.,	395 00
Harnesses, etc.,	323 61
Rebuilding old dams,	719 63
Tool boxes,	127 50
Lumber, drain pipe and coal,	295 31
Revolvers, clubs, etc.,	164 69
Advertising rules,	49 55
Stoves,	37 63
Fertilizers and seeds,	80 52
Sewer connection, Beaver Brook,	63 37
Collecting garbage, Revere Beach,	75 00
Express,	48 55
Water at fountain, etc., Revere Beach,	50 26
Refuse barrels,	55 95
Police badges,	43 25
Field glasses,	16 50
Miscellaneous,	356 61
Total,	<hr/> \$39,305 96

LANDSCAPE ARCHITECTS' REPORT.

TO W. B. DE LAS CASAS, Esq.,

Chairman of the Metropolitan Park Commission, Boston, Mass.

SIR:—The undersigned respectfully submit the following report for the year 1896. For convenience of reference the arrangement is the same as in previous years.

PART I. ACQUIRED RESERVATIONS.

A. The Rock-hill or Forest Reservations.

The reasoning which governed the selection for public domains of the areas included in Middlesex Fells, Stony Brook and Blue Hills Reservations may be found in Mr. Eliot's report to the preliminary Metropolitan Park Commission, dated January, 1893; while the carefully considered distribution of these reservations with respect to the boundary of the Metropolitan District of Boston and the centre of population at the State House is described anew in Part II of the present writing. Again, the reasoning on which was founded the choice of the exact boundaries of the lands acquired is outlined in the Landscape Architects' reports for 1893 and 1894. During 1895 the bounds were somewhat modified by additions and subtractions described in the report for that year, and during the year now closing a few further changes have been made, as follows:—

(1) The eastern and western boundaries of Stony Brook Reservation have been relocated through exceedingly rough country in such a way as to make the lines and grades and the work of constructing the boundary roads much easier, though still difficult. It was the completion of the topographical map which enabled this needed readjustment to be studied and accomplished intelligently. For the purpose of securing a convenient entrance to this reservation, plans have also been made, and adopted by the Commission, for extending

the eastern and southern boundary roads down stream along Stony Brook, as far as Gordon Avenue, Hyde Park. .

(2) For the sake of saving purchase money, certain lands have been ordered by the Commission to be returned to five different private owners on the borders of the Fells Reservation. An expression of opinion was asked of us in each case. To us it seemed that while nothing valuable was lost in one case, and only local injury was done in two cases, because the lands returned lay below the cliffs of the plateau, in two other cases, where the actual brink of the tableland was abandoned to the previous owners, considerable portions of the reservation suffered a diminution of value. Buildings constructed on these two parcels of land will, unfortunately, be visible from even remote interior portions of the reservation; and the valuable impression of unbounded extent will thus be, in part at least, destroyed. For the same reason another abandonment has been made by the Commission to the owners of the large island of private land in the midst of the eastern half of the Fells Reservation. In this case a new boundary line was devised which will eventually prove suitable for a boundary road.

(3) No additions to or subtractions from the area of Blue Hills Reservations have been made during the year, and there are only one or two small additions which need to be made.

With regard to such active work as has been done within the forest reservations during the year, only occasional consultations and suggestions have been asked of us. The demolition of the "red mills" in the Fells and the removal of the temporary headquarters of the reservation to the Frost Farm, the demolition and removal of buildings near River Street and Washington Street at Stony Brook Reservation and the continuation of the opening out as bridle paths of some of the old wood-roads of the Blue Hills, have seemed labors well worth accomplishing. The winter work of clearing away the too inflammable accumulations of dead wood—a work which was finished in the Fells and Stony Brook woodlands—was watched sufficiently to see that it was done in accordance with directions given in

previous years. Certain views respecting the desirable spirit to be cultivated in the “keepers” or police of the reservations — views founded on knowledge of experience elsewhere — have been communicated to the Commission, and in accordance with these views the patrolmen have been uniformed entirely different from city policemen. Conferences have been had with the engineer with reference to profiles and working drawings for Fells boundary roads ordered by the Commission to be constructed between Pond Street, Stoneham, and the end of Emerson Street, Melrose. A preliminary plan has been made for a necessary transverse traffic road, designed to connect East Dedham with Hyde Park by crossing Stony Brook Reservation nearly on the line of Glenwood Avenue extended. A comprehensive scheme for guide-boards for the preliminary roads of the reservations has been devised and submitted. A botanical list of the plants of the reservations, edited by Mr. Walter Deane of Cambridge, from the collections of many cordially co-operating botanists, was made up and published in the spring. It will interest all botanists to watch for the possible return of many long since evicted plants. The wild birds and animals of the reserved and protected woodlands have already greatly increased in number.

A preliminary report with respect to such work as might first be attempted in the living woods of the reservations was submitted early in the year, but no active work has yet been ordered. For reasons summarized below it is, indeed, our opinion that, except for certain rescuing work, it will be wiser to leave the woods alone, rather than to labor in them without regard to carefully considered general plans.

Lastly, by direction of the Commission, routes for two important reservation roads have been planned after study in the field and on the topographical maps: one intended to lead from that part of Harland Street, Milton, which is included in the Blue Hills Parkway, to the head of Marigold Valley in Blue Hills Reservation; the other designed to lead down through the central valley of Stony Brook Reservation from Washington Street, Boston, at the terminus of the West Roxbury Parkway, to Glenwood Avenue, Hyde Park. The first of these roads will be the extension of the

Blue Hills Parkway into the heart of the hills; the second will be the extension of the strictly pleasure driveway of the Boston Parks as far as Hyde Park on its way to the Blue Hills. Neither of these roads has as yet been ordered constructed, and, for reasons stated below and corresponding to those just mentioned in connection with work in the woods, we are confident that neither these nor any other permanent roads ought to be built in advance of the study and official adoption of a comprehensive programme embracing both the means of saving and heightening the value of all the scenery in the reservations, and the means of making that scenery agreeably accessible.*

While little important work has been accomplished in the reservations during the year, the gathering of information on which to base comprehensive plans for guiding work in the future has gone on steadily. As the publication in 1891 of a general topographical map of the whole Boston district first made possible the devising of a comprehensive scheme for a Metropolitan Park System, so the completion of the topographical maps of the separate forest reservations has now first made it possible to study intelligently schemes for their gradual development as treasuries of accessible and beautiful landscape. The contracting surveyors, Messrs. French, Bryant & Taylor, finished the maps of the Fells and Blue Hills Reservations early in the year, and the map of Stony Brook Reservation was completed by the Commission's engineering department a few months later. The original sheets of these maps are drawn to the scale of one hundred feet to an inch, and show contour lines for every five feet difference of elevation. The two maps obtained by contract are composed of fifty-eight sheets, and cloth tracings, as well as the original drawings, were supplied by the surveyors. The cost of these surveys averaged \$2.74 per acre, — a very low price, considering the complexity of the country covered and the quality of the work done. Lithographed reproductions of the combined sheets, reduced to the scale of five hundred feet to an inch, have furnished convenient working maps of the reservations, while still more reduced

* See the Landscape Architects' report to the Commission, dated Dec. 31, 1894. (Pub. Doc., 1895, No. 48, pages 34-37.)

BLUE HILLS RESERVATION.
THE ADMINISTRATION ROAD.



copies will hereafter serve as guide maps for the use of the public.

By means of sun prints from the full scale tracings, as well as copies of the lithographed maps, the further mapping and study of the existing condition of the woods and ground-cover of the reservations have gone forward, until they are now so far advanced that a detailed report on the present state of the woods, illustrated by maps and photographs, will soon be completed. By means of reference numbers entered on the maps at the places to which the corresponding notes refer, every noticeable variation in the existing vegetation has been duly recorded, while the areas occupied by the principal types of vegetation, such as meadow grass, pasture turf, pasture shrubbery, seedling forest, young sprout growth and mature sprout growth have been indicated on the maps by flat tints. Thus, in addition to the topographical survey and map of each reservation, there has now been secured a forest survey and map.

But it may be asked, Why all this preparation? Is it clear that it is necessary, or even advisable, to attempt to plan in advance how vegetation ought to be controlled and directed, and where roads ought eventually to be built? Why not swing the axe and build roads from time to time, as circumstances may seem to dictate or occasion require?

To us it seems that a due regard for the high purpose of public reservations, as well as a due regard for the economical fulfilment of that purpose, prohibits piecemeal, unrelated and hand-to-mouth work in such domains, precisely as it prohibits planless and disconnected work for the accomplishment of any and every large purpose that can be imagined, — the purposes of sewerage and water commissions, or of trustees of art museums and public libraries, for example. Park commissions are the trustees of the people's treasure of scenery, they are responsible for the safe-guarding and the increase of this treasure, and they are charged with the duty of making it most effectively accessible. Being trustees, they cannot safely proceed planlessly, any more than can those who are charged with guarding and making accessible the people's treasure of books and pictures, or with providing the people's drinking water. The

devising of comprehensive and far-seeing plans or programmes of procedure is for park commissions, as for all other executive bodies, the most necessary, arduous and responsible labor which they are called upon to perform.

It is sometimes said that the following of "general plans" will induce a regrettable formalizing of the scenery of the reservations now in question, or a lamentable taming and smoothing of what is now wild and rough. That will, however, depend on the nature of the plans adopted and the desires of the Commission which directs the planning, precisely as the style of the architecture of a church or library depends on the desires and taste of the trustees in charge of the work. If it is desired to preserve wildness and enhance the natural beauty of reservations accessible to multitudinous populations, that is precisely the thing that requires the most considerate and prophetic planning.

It is sometimes said that the mere existence of general plans tends to an extravagantly rapid prosecution of active work. There is, however, no more real danger of excess of expenditure when following a definite and comprehensive programme than there is when proceeding hap-hazard, while the following of plans gives assurance that every dollar will count toward worthy results. This, also, is a matter which lies entirely in the control of the directing body.

Our survey of the present condition of the reservations has brought out this fact, among others, — that the most pleasing existing scenery is a product of men's work in making clearings and thinnings, pasturing large areas, encouraging seedling growths and so on; and that, if even the present meagre degree of variety in the landscape is to be merely preserved, intelligent attention will need to be continually given to the control of the tree growth and the ground cover. The constant care which will be required for the preservation and encouragement of the most appropriate types of vegetation has been touched upon in previous reports. It is sufficient to say here that the studies of this year have only confirmed us in the belief that to leave the woods alone would be only to lose scenery and develop monotony, and that to preserve and enrich this scenery a well-considered programme of work must be devised for controlling and

guiding the vegetation of the reservations. Whatever is attempted ought, however, to be related to the prospective roads and other points of view, from which the scenery of the future is to be commanded. If, for example, broad-spreading trees are now encouraged to occupy a certain valley, it will prove hard to remove them when it is discovered some years hence that a vista which is obtainable only through that very hollow would be really more valuable than the trees. To proceed to "improve" the woods without reference to the positions designed to be occupied by the permanent roads will plainly result either in much double expenditure, or else in failure to secure that varied and beautiful scenery which the public has a right to expect the reservation roads to exhibit.

Conversely, it is just as true that the placing of roads ought to be largely governed by the plans adopted for the control of vegetation. If roads are devised independently there is danger that they will either seriously mar the landscape or else not effectively exhibit it. The existing preliminary roads of the reservations, opened on lines which served well the wood-choppers' commercial purposes, fail to meet the present purpose of the reservations in both of the two ways just mentioned; and for this reason, and because they have bad lines and grades, they ought to continue to be regarded as in great part temporary. To spend money in widening them or in improving their grades, to build permanent roads without regard to any programme for developing the forest scenery, or to attempt woodmen's work without reference to any road plans, will be to fix, without consideration, permanent features which will only obstruct the people of the Metropolitan District in obtaining from these reservations that measure of refreshing and uplifting enjoyment which alone can justify their great cost and their excision from the taxable area.*

B. The Lake, Brook and River Reservations.

The report of the Landscape Architects to the preliminary Metropolitan Park Commission proposed the acquisition of

* See the previous annual reports of the Landscape Architects (Pub. Docs., 1895, No. 48, pages 34-37; 1896, No. 48, pages 39, 40).

as much as might be possible of the banks of the three main rivers of the Metropolitan District, the Mystic, the Charles and the Neponset. Two and a half miles of the banks of the Mystic Ponds and the Upper Mystic or Abbajona River were acquired by the Commission in 1895, largely by gift; all but two miles of the banks of the tidal portion of Charles River have also been secured by the Commission, the Cambridge Park Commission and certain semi-public institutions, and a strip nearly half a mile long on the bank of the Neponset above Mattapan has been given into the keeping of the Commission during the past year. With the promise (should they prove desirable) of public or rentable freight landings on the navigable tidal streams, nobody now questions the great benefits to be derived from public ownership of these river margins.

As was noted in our report for last year, the Mystic River Reservation (or Parkway, as it is officially named) begins and ends illogically, while it is, also, dangerously incomplete in that the western banks of the Mystic Ponds are not controlled by the Commission. Plans for a roadway thirty-six feet in width and extending the whole length of the reservation, for the accompanying footpath, for a large amount of necessary side-slope and water's-edge grading, and for several banks to be constructed to shut out the view of the Lowell Railroad, have been prepared and delivered to the engineer, under whose direction the work of construction is now proceeding. A large part of the route of this roadway has been dug over at different times for the old Middlesex Canal, the Mystic Aqueduct and two great sewers, so that the area of raw ground to be resurfaced is uncommonly large.

The boundaries of Charles River Reservation were discussed in our report of last year, and no changes have been made during the present year, except that the line has been improved at one place close to Watertown village by moving it inland to coincide with the line of Wheeler Street. Plans have been made and submitted for a desirable, though narrow, additional acquisition of land on the Newton bank below Lemon Brook, but no action on this plan has been taken. Several abandonments have been proposed at different times, for present economy's sake. In our opinion, however, none

SIDE

THE NATURAL TIDAL RIVER

THE TIDAL RIVER WITH WALLED SHORES

THE RIVER CONVERTED INTO A FRESH WATER STREAM WITH BUSHY OR BEACHED SHORES

BRIGHTON

SIDE

CAMBRIDGE

THE TIDAL RIVER SHOWING TEMPORARY TREATMENT OF CAMBRIDGE SHORE

TYPICAL CROSS SECTIONS OF CHARLES RIVER

TO ACCOMPANY REPORT OF OLIVIER, OLIVIER & ELIOT, DATED DEC. 1, 1904

(73)



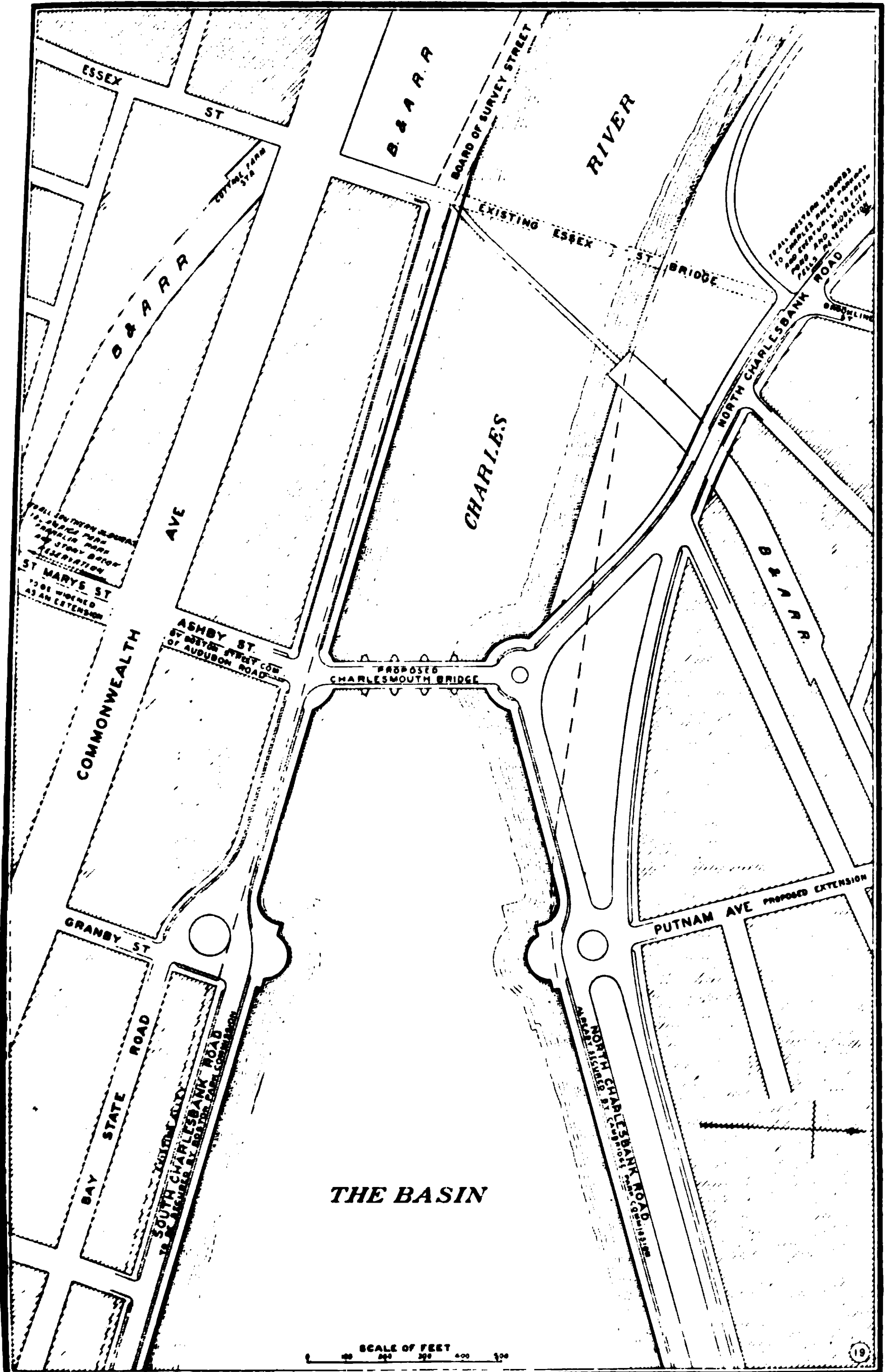
can be made without too great a sacrifice of the essential value of the whole reservation. Private industrial frontages interspersed between the irremovable Albany Railroad yards near Cottage Farm, and the Abattoir in Brighton, would greatly detract from the effectiveness and value of the remaining river-bank parkways, which must depend upon their continuity for their appearance, as well as for their usefulness for travel. We have from the first maintained that all the purchasable frontage should be purchased, and then that such portions as may be rentable should be rented to private persons during the years which may intervene before the construction of the river-bank roads or parkways may be demanded. Should occasion require, public freight landings may be provided, as above remarked, when construction is once undertaken.

On the Cambridge side of the river, between the Cambridge Hospital and Boylston Street, the construction of the North Charlesbank Road, as it may perhaps be called, is already begun. The natural river bank was here a salt marsh, subject to occasional flooding by the tide, as illustrated in the uppermost of the accompanying typical cross-sections. Not knowing whether the river will eventually have to be sea-walled, as in the second section, or whether, following the building of a dam, it may be green-banked, as in the third section, the Cambridge Park Commission has adopted the temporary mode of grading the bank, illustrated in the fourth cross-section. When it is remembered that there are, above Cottage Farm, some ten miles of salt-marsh river bank which must sooner or later be made usable, the obvious economy, as well as the greater usefulness and beauty, to be secured by the scheme which substitutes a short crosswise wall or dam near the river's mouth for ten miles of wall leading up stream and back again, cannot be questioned or disguised. Watertown, and part of Newton, with Brighton, and especially Cambridge, are now positively suffering for a decision of the question of dam or no dam. If there is to be no dam, the river ought to be dredged; if there is to be a dam, much of the dredging may be safely omitted; and so on. It is to be regretted that the joint commission which originally proposed the dam went out of existence with the

filing of its report. A project, no matter how worthy, which requires the co-operation of four municipalities, three park commissions, the State and the United States, cannot be expected to accomplish itself.

Meanwhile, and whether Charles River is to be relieved of the invading tides or not, at least the location for an adequate and handsome connection between the existing Muddy River Parkway and the proposed Charles River Parkway ought to be secured before the construction of buildings makes it too costly. As was pointed out in a report addressed to the Commission early in the year, such a connection would greatly enhance the value of the Metropolitan as well as the Boston and Cambridge parkways; and, as was then suggested, it can best be secured by widening St. Mary's Street and Ashby Street, as an extension to Charles River of the existing Audubon Road of the Boston Park System. It is about at the end of Ashby Street that the narrow Charles River empties into the broad and long Charles River basin; and here, and not at Cottage Farm, is the natural place for a bridge, to accommodate the travel which the great basin inevitably inconveniences. The accompanying diagram illustrates how such a Charlesmouth Bridge might span the stream in a manner which would terminate the basin symmetrically and architecturally; while the same diagram makes it plain that such a bridge would be an improvement over the Cottage Farm Bridge, not only for the users of the parkways, but also for ordinary traffic. It is already plain that this head of the basin is to be an important focal point of greater Boston, — a point from which broad parkways, not to speak of lines of traffic, will lead eastward along both banks of the basin and westward up the Charles to Watertown. It is also quite within reason to expect that a branch from the Charles River Parkway will lead northward by Fresh Pond to Middlesex Fells Reservation, as the Boston and Brookline Parkway now leads southward to Franklin Park and Stony Brook Reservation. So much the more reason, then, for an adequate bridge at the head of the basin, and for the extension of Audubon Road as a connecting link.

At Hemlock Gorge Reservation one small but valuable



SUGGESTIVE SKETCH FOR LOCATION OF CHARLESMOUTH BRIDGE
 TO ACCOMPANY REPORT OF OLIMTED OLIMTED & ELIOT DATED DEC 1 1896

addition has been made, the removal of several buildings has been happily accomplished, a few short bridges have been built and a little landing beach formed, under the direction of the engineer, where a mill-race formerly began. Our share in the guidance of these works has been unimportant.

At Beaver Brook Reservation a complete record has been made, by order of the Commission, of the remarkable trees and their dimensions, and small zinc labels, bearing their English and Latin names, have been attached to them. This reservation is a place of pilgrimage for botanists, teachers and school children. The town of Belmont has begun the widening of Mill Street, in accordance with a decree of the county commissioners. We endeavored, but without success, to secure a modification of the ordinary arrangement, which places sidewalks immediately adjacent to street roadways,—an arrangement which has little foundation in reason when the abutting lands are public domains. Had we succeeded, some part, at least, of the peculiar beauty of this famous old road could have been preserved, but now it will be commonplace or worse until new trees can grow.

We note that parts of both these small reservations are already badly trampled, and that the public which resorts to them is forming habits which it will be difficult to correct when the need of correction at length becomes all too evident. No general plan having been determined on for either of these reservations, we are somewhat at a loss to advise about work which it is from time to time proposed to do in them. We would respectfully suggest that prompt attention ought to be given to the consideration of the future of both reservations, and to careful planning for eventually meeting the obvious requirements of that future.

C. The Bay and Seashore Reservations.

The two reservations of this most valuable class thus far acquired both lie north-east of the State House. To the comparatively remote and small King's Beach no attention has been given by our office during the year; but to Revere

Beach and the problem of its adaptation to public use much study has, by direction of the Commission, been devoted.

Looking forward only a few years, it is obvious that a traffic and electric car route will be needed to connect Lynn with the shore towns lying between Lynn and Boston. The existing Ocean Avenue, which runs parallel with Revere Beach, furnishes about one mile of such a highway; but this avenue turns into Revere Beach Reservation at both ends in a manner which will need to be corrected. From Revere Street to the Point of Pines (and so eventually to Lynn) Ocean Avenue should be laid out as a traffic street, parallel with the reservation and necessarily adjacent to it, since the new location of the steam railroads will not permit placing the avenue even a shallow block in the rear. Southward, also, Ocean Avenue should be extended entirely clear of the reservation, and, presumably, along the route of the present electric car line. If these extensions of Ocean Avenue are not made, the necessary regulations limiting traffic, and particularly car traffic, within the bounds of the reservation, will work considerable public inconvenience. Therefore, the location of these important connections should be acquired by the town of Revere or the county of Essex before land becomes too high priced.

Concerning the boundaries of Revere Beach Reservation, it is to be noted that the long land boundary, on which a continuous row of buildings will eventually front, has from the first been designed to be a curve, conforming as closely as possible to the natural and singularly beautiful sweep of the beach itself. The legal necessity of wiping out certain public and semi-public streets and footways has resulted in obscuring the desired curve for the present, but it ought to be restored before any new buildings are built on lines not in harmony with it. This is a case where some returning of land to private ownership will distinctly improve the future appearance of the reservation. Of the abandonment to its former owners of the sea-front of the Point of Pines — one-fifth of the original length of the reservation — there is nothing to be said, except that the Commission deemed it necessary because of the lack of money wherewith to pay for the property acquired. It is not so much the loss of length

of sea-beach that is regrettable, as it is the possibility of the occupation of the conspicuous point in question by disfiguring industrial establishments.

Coming to the consideration of the Reservation itself, it is found, now that the encumbering buildings have been removed, that its value consists essentially in its broad and unobstructed view of the ocean and its own open length and continuity of curve. No spectacle more markedly contrasting with the ordinary sights of city streets can be imagined, and it follows that no place or spot can be better worth purchasing for the use and enjoyment of the people. As we understand it, it was in order that the general public might have free access to this spectacle that a million dollars was appropriated by the General Court for the acquisition of this Reservation and the removal of the railroad and buildings.

The problem is, then, to devise adequate approaches to this sea-beach and its panorama, and to provide all conveniences for the use of the visiting public, without destroying or even impairing that complete openness and continuity in which the value of this public domain consists.

Unfortunately, the beach is found, upon examination, to be what a geologist might properly call a weak beach; in other words, it is a beach which storm waves have been accustomed to raise up and drag down and even override pretty much as they pleased. The level of average high water being called grade 10 (that is, ten feet above mean low water), the waves not infrequently push seaweed up the beach as high as grade 17. Even the highest part of the crest of the beach is no higher than grade 20. The surface of the salt marshes in the rear of the beach stands at about grade 11. The most important fact is this, that the line to which ordinary storm waves reach is at present only from fifty to one hundred feet distant from the inland boundary of the Reservation. It follows that no roads, promenades, terraces, shelters, bathing establishments or other structures can be placed more than this distance from the boundary unless they are supported on retaining walls or pile wharves; while, if they are so supported, they will at once intrude upon and damage the invaluable simplicity and continuity of

the beach. Moreover, wharves are too perishable as well as too ugly in themselves; while walls, receiving the blows of the surf, will cause the waves to excavate the beach in front of them, and to throw up spray which will sometimes drench the whole width of the Reservation. Thus, for the sake of surety, safety and convenience, as well as for the sake of aspect or effect, it is desirable to allow the storm waves room to run up and expend their strength harmlessly, and to limit all construction to the first hundred feet from the boundary line.

Since the whole length of the boundary will be occupied by buildings fronting the Reservation, and since many of these buildings will be populous hotels, apartment houses, summer shops and refreshment stands, an ample sidewalk adjacent to the boundary line is a first necessity. The adopted plan makes this sidewalk twenty feet wide. As in the case of the Boston parkways, permission to open private entrances into this sidewalk should be granted only to such abutters as will agree to restrict their land against over-high buildings, obnoxious occupations and flaming advertising.

Since many people will reach the reservation by carriages and bicycles, and since no vehicles can be safely or properly allowed to mingle with the crowds on the beach itself, it seems necessary (though by no means desirable, from the point of view of foot passengers) to place next the sidewalk a roadway, which the adopted plan proposes should be forty feet in width. Lastly, and chiefly because high tides will drive the people from the beach, it seems desirable to construct a promenade on the seaward side of the roadway; and this, like the sidewalk, is proposed to be twenty feet wide. The elevation of the roadway has been fixed at grade 19, because the shape of the beach is such that to raise the grade any higher would involve a sea-wall to hold the promenade, as well as large expenditure for filling material.

When appropriately graded, this road and promenade will, for the first time, provide a suitable and agreeable approach and vantage ground from which to obtain the broad view of the ocean, and the different, but equally valuable, along-shore view of the curve of the beach, with the waves moving landward in ranks. The outer promenade, built to conform

to the natural sweep of the beach, fitted at intervals with low-roofed shelters for picnickers, and commanding throughout its length both the seaward and the along-shore views in their entirety, will form a strikingly handsome and valuable place of public gathering, provided always that no constructions involving obtrusively projecting walls or pilings are permitted outside of it.

Last summer the public had access to a projecting wooden bulkhead or terrace, which had formed an unstable foundation for a summer hotel, and the place was naturally often crowded, partly because it provided the only smooth and level standing room on the shore near the steam railroad station and the electric cars, and partly because its projection seaward enabled visitors to look past the many wharf buildings which still occupied that section of the beach. Such considerably projecting terraces or piers form, on built-up water fronts, the only means of access to the desired views, but on completely open shores they are as unnecessary as they are disfiguring, and, on sea fronts, insecure. In the case of Revere Beach, broad sea-walled "plazas" outside the promenade would only injure the views which the promenade alone, without any wharves or terraces, will command completely and most satisfactorily.

Thus, for the enjoyment of the general public, who will come to the Reservation to view the sea, the waves and the shore, the roadway, with the promenade and its occasional shelters, will provide all necessary conveniences. But what arrangements can be made for the convenience of those of the public who may desire to bathe in the sea? At this writing the Commission has not determined upon the course to be pursued, but we may be permitted to state our own views as follows:—

Supposing, for a moment, it were deemed advisable to exempt public bathing establishments from the operation of the principle that walls ought not to be permitted to project much beyond the promenade, it would then be easy to devise a structure to stand upon a sea-wall and to consist of a central office building, where suits and towels would be given out to men and women, who would then pass from this building to dressing rooms arranged along roofless alleys

to the right and left respectively. To make the dressing rooms as compact as possible, they might be built in two low stories. To properly control the use of the dressing rooms, access to the beach from the men's stack or yard of dressing rooms and from the women's stack should be by only one opening for each, the return being made through the same opening. These openings must be watched and used only by persons in bathing costume. After dressing, the way out would lead again through the central office building. Such an establishment, providing five hundred dressing rooms for men and three hundred for women, might, we find, be compressed into a space which would measure three hundred and sixty feet along the promenade and extend only sixty feet seaward. This length is fortunately short enough to enable the structure to be placed between streets, so as not to interfere with the sea view from the ends of the streets. Duplicate establishments might be built in the future between the ends of other streets, should occasion require.

If it were absolutely necessary to place bathing facilities in front of the promenade, structures of this type and these dimensions, kept low and inconspicuous, would be as unobjectionable as any that can be imagined. But, as a matter of fact, it is by no means impracticable to place the public bathing establishments, along with the hotels and private buildings, on the landward side of the road and sidewalk. The extension of the single outlets from the stacks of dressing rooms as subways running under the road and promenade is the only additional construction which this position would necessitate. By this arrangement bathers would enter the office of the bathing establishment, either directly from the electric cars in Ocean Avenue or from the reservation's sidewalk, and their passage to the beach through the airy (because open-ended) subways would involve only about forty additional footsteps in each direction. So entirely practicable is this scheme and so little would it inconvenience bathers, that we are convinced that it ought to be adopted in preference to any structure projected onto the beach. An alternative scheme, which would, in a measure, sacrifice the driving and cycling public for the sake of the bathers, would consist in bending the roadway to the rear,

and placing the bathing establishment where the road would naturally lie at the top of the beach. The preservation of the complete and impressive continuity of the open beach, to obtain which nearly a million dollars has been spent, seems to fully warrant the expenditure of some additional thousands for the purchase of land on which to place either the bathing establishment or the roadway in the rear of the present boundary of the reservation, particularly as this land will not cost more than the solid sea walls which would make a necessary part of the first plan.

It is sometimes said to be useless to spend time, pains and money in making sure that public domains are made as beautiful as they can be made, because "ordinary people will never appreciate the difference." But what if fine results are not accurately valued and their causes discerned by the multitude? We all of us experience and enjoy sensations and emotions, the causes of which are unrecognized and even unknown. When he comes into the presence of unaccustomed beauty or grandeur, the average man does, as a matter of fact, consciously or unconsciously experience a reaction, which is of benefit to him. It is on this account, and not in order to satisfy competent students of æsthetics, that our democracy has ordered the setting apart of Revere Beach and the other reservations. It is precisely for the sake of "the common people" that these reservations ought to be made to exhibit their grand or beautiful scenery just as effectively as possible. The principle that the most effective arrangement is none too good for "the common people" already governs the trustees of our schools, libraries and art museums. It has, also, been fully illustrated in many public parks. For example, Prospect Park, Brooklyn, includes a long and lovely meadow, made at large expense by joining fields together, and now extremely beautiful by reason of its great and unbroken expanse, its simplicity and its unity. The Playstead in Franklin Park, Boston, is another fine public meadow, which, like the Prospect Park meadow (and like Revere Beach), is chiefly valuable for its effective breadth, openness and continuity. Both these fields are used by tennis, croquet and ball players (as Revere Beach must be used by bathers); but are the buildings which are necessary for

the convenience of the players allowed to intrude themselves so as to shatter the effect of the meadows? On the contrary, they are in each case pushed back into the edge of the bordering woods, where they are not quite as convenient as they might be, but where they are, nevertheless, reached easily enough. At Franklin Park the players pass to and from their lockers and wash rooms by a subway which leads under the spectators' overlooking terrace, and by this means the convenience of all classes is well served, while the beautiful breadth of the meadow is preserved.

It seems to us that the preservation of the complete openness of Revere Beach is more important than the preservation of the openness of this meadow by as much as the ocean panorama and the view of the sea strand is rarer and grander than the landscape of a field.

PART II. DESIRABLE RESERVATIONS.

When studying to determine what lands would need to be removed from private ownership in order to provide the metropolitan population with adequate, agreeable and nuisance-preventing open spaces, close attention was necessarily given to the equitable distribution, as well as the suitability, of the suggested areas. Before attempting to suggest such additional spaces as might be profitably acquired should the community desire to invest in them, it will be well to point out just how the reservations already secured are related to the broad circle of the Metropolitan District and to its centre at the State House.

The accompanying circular diagram sets forth the facts as plainly as possible. In the middle of the district, and extending westward from the central Charles River Basin, lie the river-bank reservations of the Cambridge and Metropolitan park commissions, the possession of which will enable the metropolitan community to secure agreeable approaches to Boston from the westward whenever it is so minded, and to defend itself from dangerous nuisances meanwhile and always. North-north-west from the State House and between five and eight miles distant lie the Middlesex Fells, forming a reservation capable of serving for the northern suburbs all the good purposes served in the



southern suburbs by Franklin Park and the new Stony Brook Reservation, which latter open spaces lie the same number of miles from the State House in a corresponding, or south-south-west, direction. Of the small Beaver Brook and Hemlock Gorge Reservations, the first lies five miles south-west from the nearest corner of the Fells, and the second the same number of miles north-west from Stony Brook. It is also five miles from one to the other. Lastly, the Blue Hills and the Lynn Woods Reservations mate closely one with the other, both lying between the circles swept by the eight-mile and the eleven-mile radii from the State House. Revere Beach Reservation alone, lying, as it does, north-east of the State House, is not balanced by any similar reservation on the shore to the south-east of the centre of the district. On the other hand, Revere Beach fronts the open sea, and is, on that account, more valuable as a public domain than any part of the near south-east coast, which fronts on the bay only.

Such being the present remarkably equitable distribution of the principal existing open spaces, what additional spaces, if any, will it profit the Metropolitan District to acquire and control?

In the first place, it seems to us that Lynn Woods Reservation, bought and preserved as it has been by Lynn alone, ought to be rounded out to suitable boundary lines at the cost of the Metropolitan District. It is true that population is yet sparse about the outer borders of Lynn Woods, but so it is about the Blue Hills, while Lynn is topographically related to the woods exactly as is Quincy to the hills. In other words, if the Blue Hills are justly an object of metropolitan expenditure, so also are the Lynn Woods.

In the second place, it seems to us that metropolitan money may advisably be invested in acquiring water rights, easements and river-bank lands along the remarkably beautiful boating course of Charles River, between Waltham and Newton Lower Falls. This portion of Charles River, three miles in length, lies, like the Lynn Woods and the Blue Hills, just within the sweep of the eleven-mile radius from the State House. It also lies almost exactly west of the centre of the district, while the Lynn Woods and the Blue

Hills lie north and south respectively. Thus no new reservation could possibly be more equitably placed.

In previous reports it has been argued that the Metropolitan District and its constituent cities and towns would fend off evils, and, indeed, actually profit, sanitarily, pleasureably and financially, if the banks of all the larger streams and brooks (so far as they are not occupied by important industries) could be secured and controlled by public authorities. The cities of Newton and Medford, and Boston and Brookline, acting jointly, have already acquired control of certain streams, under the guidance of their municipal engineers. The separate cities ought naturally to attend to the small or local streams, while the Metropolitan Park Commission, representing the co-operating cities and towns of the whole district, might have charge of the control of the largest streams for the common benefit. The reservation of the Charles River boating course, as proposed above, and as further discussed in our report to the joint commission, dated Dec. 9, 1895, would be an important step in pursuance of this enlightened public policy.

In the third place, it seems to us that, when money is available for investment in reservations, or when gifts of land and flats are offered, the sea-shore domains of the Metropolitan Park Commission might be extended with advantage. Private and exclusive ownership of such sea and bay shores near great cities as are not adapted to commercial purposes is as little conducive to the public weal as private ownership of stream banks in crowded neighborhoods. On the other hand, public ownership tends to directly benefit not only the health of the whole community within reach of the shore, but also property for a considerable distance inland. Accordingly, we believe that it will profit the community to possess itself of water fronts as opportunity may offer, and of strips along the shores of Quincy Bay in the first instance, because the shores of this bay are related to the centre of population of the district exactly as the already acquired Revere Beach Reservation is related to the same centre. The Point of Pines, at the far end of Revere Beach, is eight miles from the State House; so also is Nut Island, the extreme promontory of Quincy Bay. Revere Beach is appropriately made a public reserva-

tion, because its exposure to the sea prevents its occupation for commercial purposes. The shores of Quincy Bay may as appropriately be dedicated to public enjoyment, because the shallowness of its waters similarly precludes commerce. Deep-water frontages of ample length are found in the adjacent estuaries of the Neponset and Weymouth rivers.

It should be specially noted that the public ownership and control of non-commercial strips of land along river banks and seashores is something very different from the public ownership of ordinary "parks." Parks like Franklin Park are valuable, indeed, but river-side and seashore strips provide access to great stores of fresh air and refreshing scenery without removing any large area from the tax lists. They do, indeed, quickly pay for themselves, because practically the whole value of the lands acquired is added to the next adjacent private lands. They, negatively, prevent the depreciation of the potential values of surrounding lands which is so generally caused by "cheap building" on freshwater and tidal shores. They place the control of the trunk lines of surface drainage under public authority, and so forbid the public from such costly expenditures for the prevention of floods as Boston has been driven to along Stony Brook in Jamaica Plain and Roxbury. Reservations of this class are primarily desirable, not for æsthetic or sentimental, but for eminently practical, reasons; while their first cost is properly to be regarded as an intelligent investment, rather than an extravagant expenditure.

PART III. METROPOLITAN PARKWAYS.

It will be remembered that, when the Metropolitan Park Commission was first required by the Legislature to spend an appropriation of \$500,000 in opening parkways, a great variety of conflicting schemes were at once proposed, comprising schemes for making parkways of existing streets in this or that neighborhood, schemes for constructing roads for the benefit of this or that body of unimproved real estate, and schemes for so distributing the expenditure that the treasuries of each city and town of the district should benefit directly from some (however small) enhancement of taxable values. In reports addressed to the Commission during 1894, we argued, on the contrary, that the selection

of the routes of parkways ought to be considered at least as comprehensively as was the selection of the sites of the reservations; that parkways built by the Metropolitan Park Commission ought to be approaches to the reservations from the populous centre of the district; and that they ought to provide, in addition to roadways for the use of carriages and bicycles, "separate passageways for the cheap, agreeable and rapid transportation of the multitude by electric cars." Designs for the Blue Hills and Middlesex Fells Parkways, based on this reasoning and approved by the Commission, were published and discussed in our report of last year. The present year has seen the land secured for both these ways, and now construction may be either postponed or hastened, as may seem best to the Commission.

With respect to the general principles on which the routes of parkways to be paid for by the Metropolitan District ought to be chosen, we see no reason to change the views expressed in previous annual reports. Whoever will study the circular diagram of the district submitted herewith will perceive several conspicuously desirable connections with and approaches to the reservations which it would profit the district to possess, for it is plain that the reservations cannot benefit the people as they ought to unless they can be made agreeably accessible. On the other hand, it is obvious that mandatory legislation, requiring the Commission to secure any particular parkways or any specifically mentioned reservations, would place the Commission in a very difficult situation as respects dealings with the owners of the lands directed to be bought, while it would probably upset such equitable and comprehensive schemes as commissions are established to devise and prosecute. If there are to be any additional Metropolitan Parkways, it is just as important that they should be placed and designed in accordance with some comprehensive scheme as it is that the reservations should be chosen, bounded and severally adapted to public use in accordance with rational and consistent general plans.

Respectfully submitted,

OLMSTED, OLMSTED & ELIOT.

BROOKLINE, MASS., Dec. 1, 1896.

ENGINEER'S REPORT.

Boston, Nov. 30, 1896.

W. B. DE LAS CASAS, Esq., *Chairman Metropolitan Park Commission.*

SIR :—I herewith submit the following report, for the year ending Nov. 1, 1896, of the work done in this department and of the incidental matters of interest.

The general scheme of organization has remained materially unchanged from that of the previous year, except necessary changes of individual men and additions to the force to meet the exigencies of the work. Assistants as far as practicable have been assigned to regular lines of work, and still further specialization will be pursued in the future, with economy and increased efficiency to the department, as the varieties of work called for assume a more permanent routine. At the beginning of the year the force engaged comprised 23 men, and this number has been increased until, at the present time, there are 32 employed in this department, rated as follows: 1 chief and 10 assistant engineers, 2 draughtsmen, 8 transitmen, 10 rodmen and 1 stenographer. The amount of pay roll has increased from about \$1,400 to \$1,800 a month.

An approximate appraisal of property belonging to the department, omitting value of maps, plans, notes and other records, made Nov. 1, 1895, was \$2,100; and Nov. 1, 1896, \$3,200.

The following is a tabulated statement of plans prepared during the year, omitting all blue print copies :—

	Abandonments and Addition- al Takings.	Boundaries.	Copies.	Grading and Construction Plans.	Individual Land Plans.	Restrictions.	Takings.	Topographical.	Office Working Plans.	Totals.
Beaver Brook Reservation, .	1	-	1	-	-	-	-	-	2	4
Blue Hills Parkway, .	-	-	2	-	7	2	2	-	3	16
Blue Hills Reservation, .	-	-	5	-	12	-	-	5	12	34
Charles River Reservation, .	2	-	2	-	8	-	2	-	3	17
Hemlock Gorge Reservation, .	-	-	1	-	-	-	1	1	4	7
King's Beach Reservation, .	-	-	-	-	-	-	2	-	-	2
Middlesex Fells Parkway, .	2	-	10	11	7	-	7	2	4	43
Middlesex Fells Reservation, .	8	1	18	12	26	-	1	1	22	89
Mystic Valley Parkway, .	1	-	9	33	8	-	4	2	5	62
Neponset River Reservation, .	-	-	-	-	1	-	-	1	1	3
Neponset River Parkway, .	-	-	-	-	-	-	-	-	3	3
Revere Beach Reservation, .	4	-	3	2	11	-	-	11	1	32
Stony Brook Reservation, .	11	1	8	4	10	-	-	12	16	62
West Roxbury Parkway, .	-	-	-	-	1	-	-	-	-	1
	29	2	59	62	91	2	19	35	76	375

Many surveys and plans of separate properties have been made for the use of the conveyancing department, and for use in the courts and in settlement of claims. Boundaries of new takings have been referred when possible to the meridian line and parallel of latitude passing through the State House. Topographical surveys and maps have been made of the Stony Brook, Hemlock Gorge and Revere Beach Reservations; of the proposed entrance to Fells Reservation from Marble Street, Stoneham; of the proposed Neponset River Parkway from Stony Brook Reservation to Paul's Bridge in Milton; and a beginning for a possible parkway in Milton and Quincy. Those topographical surveys have been made generally with plane table and stadia, cover an area of 1,009 acres, and have cost, omitting incidental expenses, \$1.75 an acre.

BEAVER BROOK RESERVATION.

Repairs have been made, under the direction of this department, on the dams of the two mill ponds. The picturesque appearance of these old weirs has led to their preservation as far as possible in their original condition, and the repairs have been made mainly with the object of strengthening the dams and stopping the leaks. Further work is needed on these, and would have been done but for the flooding of the ponds by the autumn rains, causing a cessation of all

work except that considered necessary for their safety during the coming winter.

BLUE HILLS PARKWAY.

In continuation of Blue Hill Avenue, which is to be used as a parkway within the limits of Boston, thus giving a direct line of communication from Franklin Park towards the Blue Hills Reservation, taking and restriction plans have been prepared in Milton from Neponset River along Blue Hill Avenue and Mattapan Street, across Canton Avenue, to the Harland Street entrance of the Blue Hills Reservation.

BLUE HILLS RESERVATION.

Work on this reservation has been mostly confined to retracing and verifying the taking lines, staking out of portions of the boundaries, surveys for verifying of general topographical maps, and the making of surveys and plans of particular properties. Also, the entire boundary, and the principal triangulation points used in the topographical survey, have been permanently defined by stone bounds, bolts and drill holes.

CHARLES RIVER RESERVATION.

Surveys and plans for additional takings have been made in Newton and Watertown. A topographical survey of the Charles River valley has been begun in Newton and Weston.

HEMLOCK GORGE RESERVATION.

One survey and plan have been made for an additional taking. A topographical survey of the reservation, including some of the adjoining properties, was made in January and February, and plotted to a scale of 40 feet to an inch. In removing the mill on land taken from E. J. Hickey, the raceway dam and gate were found in such a leaky and insecure condition as to render rebuilding necessary. During this work the reservoir gate and wall on the opposite or westerly side of Charles River were rebuilt, and some additional work done in filling and grading a cellar. Bids were received for this work from five local contractors, and it was awarded to the lowest, Wm. H. Mague, and was carried forward under the supervision of Assistant Engineer A. E. Horton. The raceway dam as rebuilt consisted of an

earthen embankment with core wall, the upper face finished as a beach suitable for a canoe landing and the lower slope surfaced with loam and grassed. Additional work was done in grading adjacent slopes, filling of old raceway and clearing away of rubbish. Quantities of materials used were as follows: 80 cubic yards rubble masonry core wall, in which was used 112 barrels of Rosendale cement; 14 cubic yards rubble masonry for reservoir gate, and 18 barrels of cement; 2,135 cubic yards filling used in dam construction and incidental filling and grading; 340 cubic yards filling in cellar; and 160 cubic yards loam for surfacing. The cost of the foregoing work was as follows:—

Raceway dam and filling,	\$1,693 77
Reservoir dam and gate,	160 03
Grading at cellar,	130 47
	<hr/>
Total,	\$1,984 27

A piece of grading and retaining wall, where several buildings were removed on the westerly side of the river near Central Avenue in Needham, has been done by Walter Chesley, contractor, at an expense of \$252.52. The same contractor has also in progress certain grading and removal of old buildings, between Ellis Street and the river.

MIDDLESEX FELS PARKWAY.

Proposals for the construction of the Malden section, or "Fellsway East," from Pleasant Street to Bears' Den entrance of the Middlesex Fells Reservation, were received July 19, 1895, from eight contractors. The totals of their bids were as follows:—

	Total with Broken-stone Surfacing of Roadways.	Total with Gravel Surfacing of Roadways.
Neill McBride, Brighton,	\$81,891 50	\$81,891 50
H. P. Nawn, Boston,	81,708 50	80,328 50
T. J. Kelley, Brookline,	74,931 00	70,791 00
Wm. H. Mague, West Newton,	74,371 50	71,611 50
Thos. Gavin, Watertown, Patrick Grace, Brighton, and Michael J. O'Hearn, Brookline,	67,615 50	60,715 50
R. A. Malone & Sons, Boston,	66,909 50	69,669 50
Thos. F. Maney, Quincy Point,	63,396 75	60,636 75
McCusker Bros., Waltham,	55,968 00	54,588 00

MIDDLESEX FELS PARKWAY.
FELSWAY EAST.

The contract was awarded to McCusker Bros., roadways to have a finished surface of broken stone, at the following prices per item: 35 cents a cubic yard for earth grading, \$1.25 a cubic yard for rock grading, 28 cents a foot for 8-inch drain, 34 cents a foot for 10-inch drain, 40 cents a foot for 12-inch drain, \$12 a cubic yard for brick masonry, \$4.50 a cubic yard for rubble masonry laid in cement mortar, \$2 a cubic yard for rubble masonry laid dry, 35 cents a square yard for cobble-stone gutters, \$1 a foot for edgestones, 25 cents a square yard for broken-stone surfacing, 10 cents a square yard for gravel walk, and 7 cents a square yard for loam surfacing. The construction began Aug. 15, 1895, and was completed Sept. 30, 1896. Assistant Engineer H. A. Hall has had charge of all construction on this and the Mystic Valley Parkways.

The following is a statement of the quantities, as given by preliminary and by final estimates, and the total increase or decrease in cost for each item: —

	Preliminary Estimate.	Final Estimate.	Increase.	Decrease.
Earth grading (cubic yards),	23,400	30,164	—	\$1,132 60
Rock grading (cubic yards), .	25,400	29,891	\$5,613 75	—
8-inch drain (linear feet), .	1,215	1,539	90 72	—
10-inch drain (linear feet), .	1,745	1,618	—	43 18
12-inch drain (linear feet), .	530	818	115 20	—
Brick masonry (cubic yards),	50	111	732 00	—
Rubble masonry laid in cement (cubic yards), .	40	—	—	180 00
Rubble masonry laid dry (cubic yards),	300	544	488 00	—
Gutters (square yards), . .	1,350	1,324	—	6 50
Edgestones (linear feet), .	1,110	1,248	138 00	—
Broken-stone surfacing (square yards),	27,600	31,343	935 75	—
Gravel walks (square yards),	5,700	6,661	96 10	—
Loam surfacing (square yards),	15,500	14,523	—	68 39
Extras, . . . . .	. . . . .	. . . . .	3,886 68	—
Totals, . . . . .	. . . . .	. . . . .	\$12,096 20 1,430 67	\$1,430 67
Total preliminary estimate, based on contractor's prices,	. . . . .	. . . . .	\$10,665 53 55,968 00	
Final estimate, . . . . .	. . . . .	. . . . .	\$66,633 53	

The increase in quantity of rock grading was due principally to the usual difficulty of correctly estimating, before its surface is uncovered and definitely known. The day work was mainly owing to the necessity of obtaining a large quantity of loam from outside sources, and to the cost of treatment of areas covered with waste of surplus material.

A special arrangement was made with McCusker Bros., by which additional work, not included in the previously mentioned contract, was done, — the rebuilding of a portion of Murray Street, making connection with the parkway road, and also grading at the junction with Sawyer Street. The cost of this work was \$7,540.53, according to the final estimate. The following is a summary of the cost of construction of Fellsway East from Pleasant Street to reservation, a distance of 5,200 feet, the total being well within the engineer's original estimate : —

Contract work begun Aug. 15, 1895,	\$66,633 53
Murray and Sawyer streets and connections,	7,540 53
Bills paid for catch-basin gratings, fencing, changes of water pipes, stakes, etc.,	2,081 97
Engineering and incidentals,	4,615 72
Total,	<hr/> \$80,871 75

A large amount of surplus rock excavation of a quality unsuitable for surfacing has been taken from the Malden section to the Medford section, and used for filling. The total cost of this has been \$3,513.33, which is about 25 cents a cubic yard, measured in embankment.

Plans of taking for the main line of the Middlesex Fells Parkway, from Mystic Avenue in Somerville to Pleasant Street in Malden and Salem Street in Medford, have been prepared, and construction plans for the same are completed.

MIDDLESEX FELS RESERVATION.

The boundary of this reservation has been gone over in preparation for setting of stone bounds, and the triangulation points used in the general topographical survey have been permanently marked on the ground. That portion of the reservation known as the Virginia Woods has had its boundary marked by stone bounds.

The sum of \$380.42 has been expended in making a suitable connection of Fellsway East with the existing reservation roads at Bears' Den entrance. The construction of the Border Road, extending westerly three thousand feet from Bears' Den entrance to Highland Avenue, was decided upon as a continuation in that direction of the parkway, the roadway to be twenty feet in width and finished with a gravel surface. Proposals for the construction of this road were received Aug. 24, 1896, from the following contractors: —

A. Michelini, Reading,	. . . . .	\$6,754 20
Thomas R. Howard, Malden,	. . . . .	5,893 60
M. Gill & Son, Somerville,	. . . . .	5,878 00
P. H. Byron, Medford,	. . . . .	5,054 00
David Scanlon, Arlington,	. . . . .	4,866 60
H. & D. Burnett, East Boston,	. . . . .	4,537 50
Fred E. Ellis, Melrose,	. . . . .	3,787 00
McCusker Bros., Waltham,	. . . . .	3,609 00
Andrew Carberry, East Walpole,	. . . . .	2,977 60

The contract was awarded to Andrew Carberry, at the following prices per item: 30 cents a cubic yard for earth grading, \$1.45 a cubic yard for rock grading, 23 cents a foot for 8-inch drain, 53 cents a foot for 15-inch drain, \$10 a cubic yard for brick masonry, 2 cents a square yard for roadway shaping and rolling. This work has been carried forward under the same engineering direction as that of Fellsway East, and the prospects are favorable for its completion on contract time, Dec. 1, 1896. Previous to the award of this contract a portion of the surplus rock from parkway construction had been used in building a portion of this border road to sub-grade, at an expense of \$779.75.

The construction of another border road, for which construction plans were made, has been started by the regular force employed on the reservation. This road in Stoneham will be about 2,500 feet in length, and will extend from Wyoming Avenue to Emerson Street in the edge of Melrose.

MYSTIC VALLEY PARKWAY.

Proposals for the construction of a driveway in the Mystic Valley Parkway, from High Street in Medford to Walnut Street in Winchester, were received Jan. 3, 1896. This

driveway, 36 feet in width and 2.4 miles in length, was to be built to sub-grade only, as suitable gravel for road surfacing could not be obtained within the parkway limits, and much other work was necessary for its completion. Proposals were received from the following contractors: —

John B. McKenna, Boston,	\$42,548 00
McCusker Bros., Waltham,	35,790 00
John F. O'Brien, North Cambridge,	31,648 33
Craib & Trumbull, Winthrop,	29,609 00
Thomas Gavin, Watertown,	28,383 50
John Sheehan & Co., Lynn,	29,150 00
Martin Gill & P. H. Byron, Somerville and Medford,	27,671 00
Wm. H. Mague, West Newton,	23,150 50

This contract was awarded to Wm. H. Mague, at the following prices per item: 19 cents a cubic yard for earth grading, 40 cents a cubic yard for furnishing filling material, 25 cents a foot for 8-inch drain, 33 cents a foot for 10-inch drain, 39 cents a foot for 12-inch drain, \$12 a cubic yard for brick masonry, \$3 a cubic yard for rubble masonry laid dry, \$1 a foot for edgestone, 20 cents a square yard for gravel walks and 9 cents a square yard for loam surfacing. This work was completed on contract time, Sept. 15, 1896, the final estimate amounting to \$26,055.33. The excess of this amount over the aggregate given in proposal is more than accounted for by the amount estimated at contract price for overhaul, and which does not appear in the above canvass for proposals.

A portion of the Mystic Parkway in Winchester between Mystic Avenue and Walnut Street consists of low, swampy ground, and, being a menace to the health of the neighborhood, required filling. Proposals for this filling to sub-grade were received Sept. 28, 1896, from the following: —

Charles McDermott, Brockton,	\$7,545 00
McCusker Bros., Waltham,	7,507 00
P. H. Byron & Co., Medford,	7,108 00
Cyrus Barton & C. W. Parsons, Lowell,	6,818 00
Wm. H. Mague, West Newton,	6,006 50
David Scanlon, Medford,	5,475 65
M. Gill & Son, Somerville,	5,061 00

MYSTIC VALLEY PARKWAY.
THE DRIVEWAY FINISHED TO SUB-GRADE



This contract was awarded to M. Gill & Son, at the following prices per item: 25 cents a cubic yard for earth excavation, 32 cents a foot for 12-inch drain, 85 cents a foot for 24-inch drain, \$12 a cubic yard for brick masonry, \$3.50 a cubic yard for rubble masonry and 42½ cents a cubic yard for furnishing filling material. This work is in progress at the present time.

The Mystic drive at the upper end of Upper Mystic Lake, crossing the Abbajona River near its outlet, made necessary a bridge of 50 foot span. The extremely low state of the water in the lake in July required the hastening of its construction, if advantage was to be taken of this very favorable condition. Preliminary surveys, plans, soundings and other investigations consumed so much time that it was decided to dispense with the delay that would be caused by drawing of specifications and advertising a public letting, and the work was begun August 1, by day work. Arrangements for furnishing of machinery, tools and men were made with the contractor at work on the drive. The structure as built has abutments of rubble masonry with close and deep-pointed joints laid below the bridge seat in Portland and the remainder in Rosendale cement mortar, the curving wing walls continuing on either side up the river in revetement walls for about a hundred feet. The superstructure is of the riveted, arched steel girder type. The stone was mostly furnished from a quarry in Medford, by John Reagon, he being the lowest of five bidders, at \$2.15 a perch. A small amount was furnished by other parties at a lower figure, but the stone was not as suitable for the work, and could be used only for backing. The cut stone for bridge seats and coping was furnished by the Pigeon Hill Granite Company of Rockport, for \$1,785, they making the lowest of several bids invited for this material. The Massachusetts bridge companies gave figures for the superstructure, and the contract was awarded to the Boston Bridge Company, for \$2,700. Bids were solicited from six concerns for cement, and the lowest, Berry & Ferguson, were awarded the contract, at \$2.12 a barrel for "Burham" English cement and 98 cents a barrel for "Crescent" Rosendale cement. The lumber for foundations was purchased of H. A. Emerson &

Co. of Winchester. Owing to the nature of the foundations, the structure was designed as light in weight as was consistent with good strong construction. The soil upon which the foundations rest is a very fine running sand, rendering necessary the use of tongued and grooved sheeting in excavating; and a platform was made, upon which rests the masonry, the sheeting being cut at top of footing courses and left in place. The weight of structure with maximum load is estimated to bring a pressure of three-fourths of a ton to the square foot upon the soil under the foundations. The bridge at the present time is completed, but so recently that all bills therefor have not been approved and its cost cannot now be given. Immediately upon completion of stone work bids were solicited and received from five contractors for grading the approaches. The work was awarded to the lowest, P. H. Byron of West Medford, at 27 cents a cubic yard for earth grading and $\frac{1}{2}$ a cent additional a cubic yard for each 100 feet overhaul. This work is in progress at the present time.

Specifications have been prepared and proposals invited for the completion of the grading for the remainder of the parkway, the preliminary estimate for which is \$18,250.

REVERE BEACH RESERVATION.

The work on this reservation during the past year has been mainly of a nature preliminary to proposed construction features. For this object a topographical survey has been made of the entire reservation, test borings have been made on a portion, cross-sections plotted, and investigations made to establish grades for the proposed drive. Grades and lines have been given for a number of abutting properties. Plans are in progress, showing lands taken for the new location of railroad. Plans are also being made for the construction of proposed drive along the crest of the beach.

STONY BROOK RESERVATION.

A topographical survey has been made of this reservation, of a character similar to those made for Blue Hills and Middlesex Fells Reservations, but extending somewhat out-

MYSTIC VALLEY PARKWAY.

ABBAYONA FRIDOF.

side the original taking lines. From this survey new boundaries have been determined that were better adapted for border roads, and new surveys and plans were made, showing abandonments and additional takings in consequence of these changes. Stone bounds have been set, establishing these boundaries.

A preliminary survey, with plans, has been made for a proposed road through the entire length of the reservation, from Glenwood Avenue in Hyde Park to Washington Street in Boston, and grades indicated.

A survey has also been made for a change, 1,000 feet in length, in one of the existing roads which passed outside the boundary, so as to bring it entirely within the limits of the reservation. Grades have been established for this piece of road, and it has been laid out ready for construction.

Respectfully submitted,

WM. T. PIERCE,
Engineer.

APPENDIX.

AN ACT RELATIVE TO THE METROPOLITAN PARKS AND BOULEVARDS.

[ACTS OF 1896, CHAPTER 550.]

Be it enacted, etc., as follows:

SECTION 1. The metropolitan park commission shall, prior to the first day of January in the year nineteen hundred, take all the lands which it is authorized to take, and shall lay out and construct all the parks, reservations, boulevards and other works which it is authorized to lay out and to construct, and the treasurer of the Commonwealth shall pay from the proceeds of the loans authorized for the purpose of meeting the expense of taking said lands, of laying out said parks and reservations and of constructing said boulevards and other works, or from the proceeds of any of said loans, all moneys required prior to and including the first day of January in the year eighteen hundred and ninety-six to and including said first day of January in the year nineteen hundred, to meet the interest and sinking fund requirements for said loans as estimated by said treasurer and to meet the cost of maintenance and operation of said parks, reservations, boulevards and other works as annually authorized by the legislature, and to meet such amount as has heretofore been paid from the treasury of the Commonwealth for such cost.

SECTION 2. The supreme judicial court sitting in equity shall in the year nineteen hundred, and in every fifth year thereafter, on the application of said commissioners or of the attorney of either of the cities or towns in the metropolitan parks district, and after notice to each of said cities and towns, appoint three commissioners, neither of whom shall be a resident of either of said cities and towns, who shall, after such notice and hearing as they shall deem sufficient and in such manner as they shall deem just and equitable, determine the proportions in which each of said cities and towns shall pay money into the treasury of the Commonwealth each year for the term of five years, beginning with the first day of January in each year in which such commissioners are required to be appointed, to meet said interest, sinking fund requirements, and cost, for such year, and any deficiency in the amount previously paid in as found by said treasurer, and shall return their award into said court: *provided, however,* that the commissioners

shall fix and return the proportion to be paid by the city of Boston for each year of the first of said terms at fifty per cent. Every such award when accepted by the court shall be a final and conclusive adjudication for the term, of all matters referred to the commissioners, and shall be binding upon all parties.

SECTION 3. The treasurer of the Commonwealth shall in the year nineteen hundred, and in each year thereafter, estimate, in accordance with the proportions determined as aforesaid, the several amounts required during the year beginning with the first day of January, from the cities and towns aforesaid, to meet said interest, sinking fund requirements, and cost, for such year, and deficiency, if any, and shall include the amount required from a city or town, in, and make it a part of, the sum to be paid by such city or town as its annual state tax, and the same shall be paid by the city or town into the treasury of the Commonwealth at the time required for the payment, and as a part, of its state tax: *provided, however,* that the moneys to be paid into the treasury of the Commonwealth each year, and the amount to be paid by the Commonwealth and made a part of the annual state tax levy, shall be as specified in section ten of chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three, and in section eight of chapter two hundred and eighty-eight of the acts of the year eighteen hundred and ninety-four.

SECTION 4. Sections ten, eleven and twelve of chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three, sections eight, nine and ten of chapter two hundred and eighty-eight of the acts of the year eighteen hundred and ninety-four, all acts in amendment of or in addition to said sections or either of them, and all other acts or parts of acts inconsistent with this act, are hereby repealed, and the treasurer of the Commonwealth shall not hereafter require the payment of, and no city or town shall hereafter pay, any money into the treasury of the Commonwealth under any determination or finding of any commission appointed under the provisions of said sections, or any of them.

SECTION 5. This act shall take effect upon its passage. [*Approved June 9, 1896.*]

OPINION OF THE ATTORNEY-GENERAL.

JULY 23, 1896.

Hon. JOHN W. KIMBALL, *Auditor*.

DEAR SIR :— Your letter of June 22 requests an opinion as to the construction of Statutes 1896, chapter 550, relative to the Metropolitan Parks and Boulevards. In order to understand the questions raised it is necessary to review the legislation relating to Metropolitan Parks.

The Metropolitan Park Commission was created, and authorized to lay out and construct parks, by Statutes 1893, chapter 407. By section 9 of that act a loan of one million dollars was authorized for a term not exceeding forty years, “to meet the expenses incurred under the provisions of this act.” It was not the purpose of the Legislature, however, to impose the burden of the laying out, construction or maintenance of the Metropolitan Parks upon the Commonwealth. A policy of reimbursement from the cities embraced within the Metropolitan District was established in the original act, which has never been departed from in any subsequent legislation. The act in question provided that a special commission should be appointed for the purpose of determining substantially the proportion in which the expenses of Metropolitan Parks should be borne by the cities and towns in the Metropolitan District. The proportion assessed upon Boston was to be fifty per cent. of the whole. The proportion to be assessed upon the other cities and towns was to be determined by this special commission so constituted. A sinking fund was created by the act authorizing the loan, the annual contributions to which should be sufficient to extinguish the debt on maturity. Section 12 of the act provided that the amount of money required each year from the cities and towns in the district to meet the interest, sinking fund requirements and expenses for each year should be estimated by the treasurer in accordance with the proportion established by the special commission, and assessed upon such cities and towns as a portion of their State tax. By the operation of this plan, therefore, although all the moneys required for Metropolitan Parks was to be raised by the Commonwealth by means of a loan, and advanced when necessary, the whole of the principal and interest of said loan, and the expenses of maintaining the parks,

were eventually to be assessed as a tax in the proportion thus ascertained upon the cities and towns of the district.

A special commission was thereupon appointed by the supreme judicial court, which proceeded to hear the parties, and to assess the proportion to be paid by each city and town within the district. This report was ultimately confirmed by the court. From time to time additional authority to expend money in laying out and constructing parks and parkways was granted to the Commission, and loans for corresponding amounts authorized to be made by the treasurer to meet the expenses thereof; the whole amount of loans so authorized being \$4,300,000. The last loans voted were by Statutes 1896, chapters 466 and 472. By chapter 466 the Park Commission was authorized to "expend the further sum of one million dollars in addition to all sums heretofore authorized to be expended by it;" and to meet the expenditures so authorized to be incurred the treasurer was directed to issue a corresponding amount of scrip or certificates of indebtedness. By chapter 472 the Commission was authorized to expend the further sum of five hundred thousand dollars for roadways and boulevards, and a corresponding loan was authorized to be made by the treasurer. The acts were approved June 4, 1896, and took effect upon their passage.

Under the act creating the Park Commission (Statutes 1893, chapter 407) it was directed to estimate annually the expense of preservation and care of the parks for the ensuing year and certify the same to the treasurer, such expenses to be apportioned among the cities and towns in the same manner as the expenses of location and construction. This estimate was limited in the original act at twenty thousand dollars, but the limitation was afterwards removed. In pursuance of this authority, estimates have been made by the Commission from time to time, and the Legislature has each year appropriated sums of money to be paid out of the ordinary revenue for the care and maintenance of the parks, to wit: 1894, \$20,000; 1895, \$37,000; 1896, \$40,000. Under the statutes of appropriation these sums were not taken from the park loans, but were imposed upon the cities and towns in the district, in addition to the amounts authorized for laying out and construction.

Complaint was made by some cities and towns that the apportionment established by the Commission was necessarily premature,—being made before the completion of the work of laying out and constructing the parks, and, therefore, possibly unfair. The statute under consideration (Statutes 1896, chapter 550) was undoubtedly passed in recognition of the justice of these complaints. It does not undertake to change or modify the purpose originally declared by the Legislature of assessing the expenses

of the laying out, construction and maintenance of Metropolitan Parks upon the cities and towns within the district. But it abolishes the work of the special commission above referred to. It further directs the Park Commission to lay out and construct all the parks which it is authorized to construct before the first day of January, A.D. 1900; and further provides that during the year 1900 a new special commission shall be appointed to assess the proportions to be paid by the several cities and towns in the district, in the same manner as was provided by the original act. The necessary intent of this law is, not to impose any part of the burden of Metropolitan Parks upon the Commonwealth, but to postpone the time when the cities and towns shall begin to reimburse the Commonwealth for the money advanced by it for that purpose. But, inasmuch as it would be onerous to require the cities and towns in the district to pay in one sum all the interest and fixed charges, and expenses of maintenance incurred from the beginning of the enterprise up to the year 1900, the act provided that all these charges and expenses should be paid by the treasurer out of the loans authorized. The result of this will be that in the year 1900 the only demand upon the cities and towns will be the bonds then outstanding, the interest, sinking fund requirements and all expenses of care and maintenance accruing prior to that time having been paid out of the loan itself. It follows that the time of beginning reimbursement to the Commonwealth by the cities and towns is thus postponed for four years; but as a necessary result of this either the amount to be expended for parks and boulevards must be reduced, or the amount to be paid by the cities and towns must be increased. This is because the whole sum which the cities and towns assume from and after the first day of January 1900 includes all interest and sinking fund requirements and expenses of maintenance to that date; these sums being necessarily either added to the whole loan, which is thus made greater, or taken from the loans now authorized.

The question stated in your letter is this, substantially: Is it the intent of the act that the loans heretofore authorized shall be increased by the amount of the interest, sinking fund requirements and expenses of maintenance already incurred and to be incurred between now and the year 1900, or are these expenses to be deducted by you from the fund created by the loans already authorized? The question is one of importance, because the necessary result of deducting all the charges and expenses so imposed upon the loan itself is to cripple seriously the work of the Park Commission, by diminishing the amount of money placed at their disposal by previous acts, the last of which was enacted June

4, only five days before the act in question took effect. If you are to reckon only such expenses as already have been authorized, and the interest and sinking fund requirements now contracted for, the amount to be deducted from the fund created by the park loans will be, I am informed, about \$700,000. If the statute requires you to go further, and deduct such sums as you estimate will be required for expenses from this time until the year 1900, the amount to be deducted will be about \$950,000, or nearly the whole amount which the Commission was authorized to expend upon parks, under the authority of the act of June 4 passed by the same Legislature.

It is claimed by the Park Commission that it is inconceivable that the Legislature on the fifth day of June should authorize the Commission to expend the sum of one million dollars, and on the ninth day of June practically take away this power. The act of June 5 was passed after a careful consideration of the purposes and needs of the Commission. I am told that it was stated by the Park Commission to the Legislature that the sum of one million dollars was needed to complete the parks according to the plans under consideration before them; and the statute of June 5, giving them that sum, must be taken to be a recognition by the Legislature of the needs of the Commission at that time.

The Park Commission claim that both acts must be construed to stand, rather than fall; and that the latter act must be taken to be an authority, express or implied, for an additional loan by the treasurer to meet the charges and expenses so imposed upon the loan itself.

There is much force in this contention, but the difficulty in the way is that it is not sustained by the plain language of the last statute, being the one under consideration. Section 1 of this statute provides, in express terms, that "the treasurer of the Commonwealth shall pay from the proceeds of the *loans authorized*" all moneys required up to and including the first day of January, 1896, to meet interest and sinking fund requirements and cost of maintenance. The Legislature of 1896 cannot be said to have required the treasurer to speculate upon the chances that a future Legislature would authorize an additional loan. The words "loans authorized" cannot be construed to mean loans hereafter to be authorized. A loan is not authorized until the act therefor is passed by the Legislature; and I cannot advise you that the Legislature of 1896 gave you any ground by the language of section 1 to expect that an additional loan would be authorized by a future Legislature. A legislative body cannot bind its successor, nor can it authorize the officers of the government to act

in anticipation of what may be authorized by a succeeding Legislature.

Still less can the section be said to be a present authority for an additional loan. The language not only does not warrant such an inference, but it plainly points to the contrary; it directs the treasurer to pay the charges in question out of the "loans authorized," not out of loans to be created therefor.

I am of opinion, therefore, that it is your duty to charge to the account of the fund created by the Metropolitan Park loans heretofore authorized, such a sum of money as will be sufficient to meet the interest and sinking fund requirements up to and including the first day of January, 1900.

It is probable that, so far as the intent of the Legislature can be ascertained from the language of the section, it was expected that further expenses of care and maintenance of the parks, as "annually authorized" by the Legislature, should also be paid out of the same fund. In my judgment, however, it is impossible for you to carry out this intent. You cannot even estimate what may be the action of future Legislatures. It is not sound logic to estimate from the action of previous Legislatures what will be the amount appropriated by future Legislatures for care and maintenance. The General Court is the sovereign, and no citizen or officer can presume in advance what its action will be. If you were to undertake to reserve any sum of money out of the park loan fund for future care and maintenance, there is no middle ground; it would be your duty to reserve the entire loan to await the action of future Legislatures up to the first of January, 1900. The result of this would be to stop all work upon the parks. Notwithstanding the evident meaning of the language of the act, I am of the opinion that you are not called upon at this time to set apart any portion of the fund for future unascertained and unascertainable contingencies. It is your duty to charge the fund with all the amounts heretofore appropriated for care and maintenance. When you have done this, your duty in this respect is discharged. If a succeeding Legislature shall, in the exercise of its sovereign power, appropriate a sum of money for care and maintenance of the parks, and, under the authority given by the previous Legislatures, all the then available proceeds of park loans have been expended by the Commission for the purposes of park construction, it is to be presumed that the Legislature which makes the appropriation will provide the means for its payment, either out of the ordinary revenue or by authorizing a new loan.

Very truly yours,

(Signed)

HOSEA M. KNOWLTON, *Attorney-General.*

METROPOLITAN PARKS LOANS.

ANALYSIS OF PAYMENTS FROM JAN. 1, 1896, TO
DEC. 3, 1896, PREPARED IN STATE AUDITOR'S
OFFICE.

SERIES I.

<i>Blue Hills Reservation.</i>			
Axes,	\$62 74		
Carriage hire,	41 00		
Galvanized wire, etc.,	96 02		
Hardware,	15 30		
Hire of horses,	1,696 56		
Labor,	21,884 75		
Lumber,	31 50		
Peppermint,	15 08		
Posts,	72 00		
Photographs,	16 00		
Stakes,	17 60		
Sharpening tools,	405 00		
Travel,	18 00		
Telephones,	44 26		
Tools,	43 70		
Balch & Rackemann,	1,018 27		
Experts,	259 75		
French, Bryant & Taylor,	2,510 29		
Louis E. Hawes,	294 23		
Olmsted, Olmsted & Eliot,	138 30		
Samuel D. Parker,	25 00		
J. Herbert Shedd,	163 34		
George W. Morton,	118 35		
Land : —			
Charlotte W. Allen,	33 33		
Zenas S. Arnold, attorney,	180 00		
Lewis Bass and Sarah E. N. Ed- wards,	5,914 00		
Tobias H. and Thomas F. Burke,	150 00		
Sarah E. N. Edwards,	600 00		
Jere P. Fenno,	178 56		
Joseph H. Farrington,	6,380 92		
George A. Fletcher,	240 18		
Hiram A. French,	91 00		
William S. Greenough,	73 33		
Susan J. Hollingsworth,	241 50		
Edward E. Howe <i>et al.</i> ,	287 49		
Mary S. Kittredge <i>et al.</i> ,	90 00		
Thomas L. Livermore,	146 67		
Helen M. Mansfield,	1,000 00		
Town of Milton,	814 69		
Lucy F. J. Newton,	287 49		
<i>Amount carried forward, . \$45,696 20</i>			

Analysis of Payments, etc. — Continued.

<i>Amount brought forward,</i>	<i>.\$45,696 20</i>		
Jeannie W. Paine,	2,800 00		
Rufus Pierce,	500 00		
Suffolk Savings Bank,	5,330 13		
Robert Sugden <i>et al.</i> ,	33 34		
J. Henry Taylor, trustee,	695 00		
Charles O. Wales,	1,425 00		
Ellerton P. Whitney <i>et al.</i> ,	5,936 70		
Total,		\$62,416 37	
<i>Middlesex Fells Reservation.</i>			
Axes,	\$55 50		
Coal,	5 53		
Chimney,	10 40		
Drafting plans,	10 00		
Damages,	150 00		
Dynamite,	29 55		
Doors and frames,	39 65		
Carpenter work,	140 00		
Experts,	1,296 20		
Fence,	11 32		
Furnace,	163 00		
Gravel,	10 92		
Hardware,	58 54		
Hire of horses,	2,445 55		
House, barn, etc.,	750 00		
Labor,	14,334 70		
Lumber,	430 58		
Mantel,	8 10		
Plumbing,	442 61		
Painting,	128 77		
Repairs to building,	110 00		
Shingling building,	375 00		
Stove,	12 00		
Sharpening tools,	196 20		
Stakes,	11 25		
Sheriff's services,	57 90		
Stone wall,	65 00		
Balch & Rackemann,	4,660 85		
Elder, Wait & Whitman,	15 00		
French, Bryant & Taylor,	1,742 86		
Alfred S. Hayes,	25 00		
Olmsted, Olmsted & Eliot,	220 41		
Thomas O'Loughlin,	45 00		
Edward E. Rand,	25 00		
Henry C. Rand,	900 00		
Charles F. Spear,	100 00		
J. E. Wolff,	25 00		
C. L. Whittle,	200 00		
M. P. Wright,	50 00		
Land:—			
Emma I. S. Adams,	116 75		
<i>Amounts carried forward,</i>	<i>.\$29,474 14</i>	\$62,416 37	

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward, .</i>		<i>\$29,474 14</i>	<i>\$62,416 37</i>
Francis P. Adams,	707	28	
Mary E. B. Albertson,	50	00	
Sarah Atkinson,	2,485	00	
George D. Ayers,	600	00	
Selwyn Z. Bowman, attorney,	900	00	
Francis Burke, attorney,	4,500	00	
Francis H. Bacon,	3,042	50	
Elizabeth Baldwin,	750	00	
John A. Barnes,	2,002	34	
Mary J. Basford,	30	00	
Boston Rubber Shoe Company,	15,740	58	
Emma F. Bowers,	100	00	
John H. Brennan,	500	00	
James Briggs,	557	50	
Charles Butters,	2,600	00	
Helen L. Butterfield,	787	79	
Lucretia F. Carr <i>et al.</i> ,	1,000	00	
George T. Connor,	948	00	
Susanna C. Cook,	925	50	
Joseph Faulkner <i>et al.</i> ,	1,760	00	
Charles A. Frost,	11,000	00	
David and William Jamieson,	45	20	
William P. Greeley,	15,000	00	
Mary A. Guerineau,	400	00	
Sidney A. Hill,	600	00	
Benjamin Hitchings,	500	00	
George W. Holden,	1,262	50	
Harry Hunt,	50	00	
Emily H. Hayward,	350	00	
Henry Lynde,	2,500	00	
Mary E. Johnston,	237	66	
Samuel C. Lawrence,	57,483	40	
Elizabeth C. Locke <i>et al.</i> ,	336	50	
D. H. McKay,	5,910	40	
Ellen McCarthy,	3,672	50	
Melrose Savings Bank,	527	50	
Robert S. Minot, trustee,	6,000	00	
Esther M. Morcombe,	200	00	
Harriet E. Makechnie,	3,100	00	
New England Hospital for Women and Children,	3,057	50	
Joseph W. Noble,	1,093	75	
Aaron B. Magoun,	6,300	00	
Thomas Quigley,	7,147	10	
Jennie W. Page,	2,700	00	
Charles Ramsdill,	350	00	
Mary O. Rolfe,	73	90	
John A. Scott,	45	20	
William J. Scott,	30	80	
Mary A. A. Scrannage,	6,525	00	
William Scrannage, executor,	1,015	00	
Mathilda E. Stantial,	800	00	
<i>Amounts carried forward, \$207,774 54</i>			<i>\$62,416 37</i>

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward, \$207,774 54</i>		\$62,416 37	
Severin St. Denis,	6,500 00		
Arvilla N. Stocker,	1,093 75		
Joseph Swan,	550 00		
Marshall Symmes,	3,050 00		
Ida R. Tay,	3,500 00		
Samuel Teele,	2,165 00		
Town of Stoneham,	825 00		
Mary E. Upham,	75 00		
Nellie S. Washburn,	31 00		
William C. Wait, attorney, . .	3,000 00		
Ida E. Wadsworth,	3,500 00		
Horace E. Willis,	9,320 00		
Mary F. Walling,	267 00		
Ellen M. Wright,	6,889 00		
William Wood,	300 00		
Jonathan Munyan <i>et al.</i> , trustees, .	43,671 03		
Total,		292,511 32	
<i>Beaver Brook Reservation.</i>			
Carriage hire,	\$4 00		
Cement,	20 70		
Flag,	11 50		
Labor,	1,227 23		
Horses,	205 85		
Photographs,	19 25		
Plumbing,	20 75		
Repairs on street,	83 87		
Sharpening tools,	11 75		
Uniform for officer,	24 50		
Balch & Rackemann,	112 25		
B. McCusker,	95 80		
Olmsted, Olmsted & Eliot,	88 30		
Total,		1,925 75	
<i>Stony Brook Reservation.</i>			
Bath house and fence,	\$105 00		
Hire of horses,	474 84		
Labor,	2,972 75		
Lumber,	9 66		
Photographs,	9 00		
Plumbing,	110 00		
Posts,	84 00		
Sharpening tools,	2 03		
Stakes,	10 00		
Travel,	140 00		
Witnesses and experts,	2,370 00		
Balch & Rackemann,	585 83		
J. H. Burt & Co.,	175 00		
Olmsted, Olmsted & Eliot,	157 13		
J. E. Wolf,	25 00		
C. E. Johnson,	100 00		
C. H. Whittle,	160 00		
<i>Amounts carried forward, \$7,490 24</i>		\$356,853 44	

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward,</i>		\$7,490 24	\$356,853 44
J. S. Coveney,	.	100 00	
George W. Morton,	.	315 00	
Land:—			
Hannah B. Basto,	.	4,750 00	
Andrew J. Browne,	.	6,121 41	
Edmund Daily,	.	9,000 00	
Cotter & Fellows, attorneys,	.	18,780 00	
Heirs of William Enslin,	.	2,500 00	
Laura B. Ellison,	.	1,220 00	
Alice Island,	.	10,000 00	
Fredericke Ruelberg <i>et al.</i> ,	.	360 00	
Nathaniel M. Safford,	.	10,500 00	
James C. Sharpe,	.	300 00	
Mary M. Stevens,	.	2,183 75	
John W. Smith,	.	20,000 00	
William M. Thompson,	.	50 00	
Clifton S. Thompson,	.	50 00	
William C. Sharp,	.	200 00	
Trustees Eliot School,	.	5,500 00	
Charles F. Jenney, attorney,	.	5,250 00	
Total,	.		104,670 40
<i>Revere Beach Reservation.</i>			
Advertising,	.	\$385 19	
Building foundation for bridge,	.	442 00	
Cement,	.	14 75	
Cementing cellar, etc.,	.	185 00	
Drinking fountain,	.	35 00	
Electric lights,	.	167 50	
Drains,	.	199 00	
Experts,	.	396 93	
Flag,	.	15 00	
Gravel,	.	7 82	
Hot water heater,	.	300 00	
Horse hire,	.	58 62	
Labor,	.	613 18	
Plans,	.	26 03	
Photographs,	.	60 00	
Police station,	.	699 61	
Piping,	.	60 42	
Painting,	.	332 00	
Papering,	.	42 62	
Plumbing,	.	41 45	
Repairs to bulkhead,	.	275 00	
Repairs to fence,	.	26 30	
Repairs to superintendent's house,	.	960 00	
Screens,	.	24 25	
Stenographers,	.	182 17	
Sheriff's services,	.	13 06	
Travel,	.	28 00	
Work on band stand,	.	17 00	
<i>Amounts carried forward,</i>		\$5,607 90	\$461,523 84

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward,</i>	\$5,607 90	\$461,523 84
Window shades,	16 20	
Water meter,	59 19	
Witness fees,	69 02	
W. T. Pierce,	5 64	
Balch & Rackemann, . . .	2,430 97	
B. F. Flinn,	305 00	
Olmsted, Olmsted & Eliot, .	69 48	
George A. Torrey,	10 00	
E. K. Turner,	879 00	
Stickney & Austin,	75 00	
William T. Eaton,	2,318 00	
Boston, Revere Beach & Lynn Railroad,	50,843 06	
Land : —		
Melvin O. Adams, attorney, .	3,933 42	
J. Harris Aubin,	2,000 00	
Boston Co-operative Bank, .	539 76	
Washington G. Benedict, . .	58,179 93	
John A. Daly,	1,000 00	
John J. Donovan,	546 86	
Margaret Daly,	2,594 47	
County Savings Bank, . . .	6,141 78	
Nicolas Estevez,	1,863 00	
John D. Cobb,	169 60	
Hepsebeth Fenton,	2,818 97	
Otis L. Fern, trustee, . . .	3,827 83	
David Floyd,	1,652 50	
Wm. E. Flynn, trustee, . . .	1,935 07	
Louisa J. Govan <i>et al.</i> , . . .	500 00	
Mary C. Griffith,	2,459 38	
France B. Hiller,	7,000 00	
William T. Hall,	2,200 00	
Patrick Hargrove,	1,727 95	
Charles H. Hayden,	1,000 00	
Marcella A. Kirby,	11,000 00	
George S. Lee, trustee, . . .	1,760 00	
James and Patrick Manning, .	1,600 00	
Donald K. McLeod,	1,600 00	
Arthur D. McClellan,	1,760 00	
Elizabeth McDonald,	1,500 00	
Dominic Maggi, trustee, . . .	788 25	
Jeremiah Mara,	546 86	
Mary E. Murphy,	2,112 39	
Philip J. Myer,	701 83	
Charlotte McLeod,	1,600 00	
Edward J. Murphy,	1,000 00	
Robert F. Naylor,	227 55	
Ida E. Pearce,	6,100 00	
Virginia F. Potter,	314 95	
William G. Reed,	1,109 84	
Town of Revere,	686 88	
<i>Amounts carried forward,</i>	\$198,687 53	\$461,523 84

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward,</i>		\$198,687 53	\$461,528 84
Frank P. Rogers, attorney, . . .	1,735 28		
Francis A. Sproul, . . .	2,250 00		
Clarence C. Smith, . . .	172 50		
John Sheehan, . . .	3,427 24		
William Smith, . . .	1,000 00		
Suffolk Co-operative Bank, . . .	190 40		
Augustus L. Thorndike, . . .	262 50		
Augustus L. Thorndike, guardian, . . .	1,017 00		
Eugene Tompkins, . . .	509 58		
Trustees Lexington Ministerial Fund, . . .	515 00		
William H. H. Tuttle, . . .	418 00		
William Watters, attorney, . . .	5,100 00		
William W. Webster, . . .	3,955 14		
Total, . . .		219,240 17	
<i>West Roxbury Parkway.</i>			
Balch & Rackemann, . . .	\$286 95		
George E. Black, . . .	80 00		
Land: —			
Cyrus F. and David F. Decatur, . . .	2,391 74		
Germania Co-operative Bank, . . .	402 02		
Alice J. Hennessy, . . .	649 17		
Sophia Hasenfus, . . .	1,797 98		
Mary A. Hogan, . . .	360 00		
W. S. Mitchell, . . .	3,200 00		
Henry Schulkorf, . . .	137 50		
Daniel Sullivan, . . .	770 00		
Frederick C. M. Damm, . . .	1,000 00		
Lizzie A. Damm, . . .	1,000 00		
Mathilde E. Rietzel, . . .	500 00		
William C. Rietzel, . . .	500 00		
Total, . . .		13,075 36	
<i>Hemlock Gorge Reservation.</i>			
Bagging, . . .	\$3 25		
Experts, . . .	100 00		
Cement, . . .	131 55		
Carpenter work, . . .	11 40		
Grading, . . .	252 52		
Hats, . . .	8 00		
Hire of horses, . . .	16 50		
Labor, . . .	1,244 28		
Ladders, . . .	2 95		
Photographs, . . .	20 40		
Painting, . . .	26 25		
Rebuilding raceway dam, etc., . . .	1,485 73		
Rowboat, . . .	24 50		
Repairs, . . .	125 00		
Stakes, . . .	5 75		
Travel, . . .	22 00		
<i>Amounts carried forward,</i>		\$3,480 08	\$693,839 37

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward,</i>	\$3,480 08	\$693,839 37
Uniform for officer,	24 50	
Balch & Rackemann,	477 81	
Olmsted, Olmsted & Eliot,	35 73	
A. A. Savage,	15 00	
W. T. Pierce,	32 26	
Daniel Hurley,	800 00	
Land:—		
Henry W. Fanning,	4,900 00	
Mary Leach,	3,000 00	
Henry W. McIntosh <i>et al.</i> ,	1,787 94	
Jemima S. Wood,	712 06	
Clara M Taylor,	3,883 20	
Harriet S. Towle,	116 80	
Total,		19,265 38
<i>King's Beach Reservation.</i>		
Photographs,	\$20 00	
J. W. Southworth,	40 00	
Balch & Rackemann,	644 00	
Total,		704 00
<i>Charles River Loan.</i>		
John Woodbury, assistant secretary,	\$52 08	
Olmsted, Olmsted & Eliot,	916 78	
William T. Pierce,	8 41	
Balch & Rackemann,	3,298 40	
John C. Cobb,	125 00	
Experts' services,	250 00	
Labor,	409 48	
Maps,	54 00	
Photogravures,	399 82	
Stakes,	3 25	
Travel,	17 50	
Land:—		
Abby V. Barry,	875 00	
Charles V. Bemis,	875 00	
John E. Cassidy,	18,675 00	
Amelia W. A. Eldridge,	13,447 00	
Benjamin M. Fiske,	10,166 67	
Farmers and Mechanics Savings Bank,	2,275 00	
Henry B. Goodenough,	8,443 00	
Elizabeth B. Howard,	3,574 00	
Phœbe G. Hosford <i>et al.</i> ,	350 00	
Mark A. Lawton,	1,140 00	
Francis Burke,	4,848 60	
Brighton Five Cents Savings Bank,	10,177 80	
<i>Amounts carried forward,</i>	\$80,381 79	\$713,808 75

Analysis of Payments, etc. — Continued.

Amounts brought forward, .	\$80,381 79	\$713,808 75	
Thomas W. Carter,	4,848 60		
Granville A. Fuller,	5,125 00		
George H. Jaques,	9,833 33		
John R. Magullion <i>et al.</i> ,	2,000 00		
Margaret T. McCormack,	5,000 00		
Joseph W. Pearson, attorney,	15,000 00		
Watertown Savings Bank,	10,426 00		
Town of Watertown,	195 00		
W. H. Wade, attorney,	1,500 00		
Total,		134,309 72	
John Woodbury, assistant secretary,	\$156 25		
Alice G. Kelley, clerk,	347 92		
Mary C. Godvin, clerk,	60 00		
William T. Pierce,	97 96		
Olmsted, Olmsted & Eliot,	2,998 69		
George L. Rogers,	125 00		
F. S. Goodwin,	646 00		
Balch & Rackemann,	11,666 66		
Drawing material,	197 79		
Electric lighting,	6 04		
Furniture,	6 00		
Janitor's services,	60 00		
Hardware,	1 37		
Labor,	6,945 10		
Levels,	30 00		
Maps,	475 06		
Plumb bobs,	25 20		
Posts,	620 20		
Photogravure plates and printing,	934 56		
Rent of rooms, 13 Exchange Street,	329 17		
Rent of rooms, Ames Building,	400 00		
Repairing instruments,	16 30		
Stationery,	94 08		
Stakes,	35 45		
Tape measure,	13 50		
Travel,	60 45		
Telephone,	83 63		
Towel supply,	10 75		
Typewriting,	6 10		
Water cooler,	12 85		
Total,		26,462 08	
Total expenditures in Series I.,			\$874,580 55

SERIES II.

<i>Blue Hills Parkway.</i>		
Balch & Rackemann,	\$592 52	
Olmsted, Olmsted & Eliot,	250 00	
Carriage hire,	77 50	
Experts,	600 00	
Horse hire,	325 08	
Labor,	301 50	
Gravel,	51 00	
Travel,	32 00	
Sharpening tools,	15 00	
Total,		\$2,244 60
<i>Middlesex Fells Parkway.</i>		
Advertising,	\$123 93	
Building engineers' office,	102 00	
Changing hydrants,	60 05	
Covers,	80 00	
Fence,	75 00	
Grates, etc.,	319 00	
Horse hire,	70 00	
Hardware,	7 34	
Labor,	377 35	
Posts,	215 00	
Photographs,	16 00	
Pole and scraper,	1 50	
Piping,	234 31	
Rent of house, Malden,	20 00	
Stone,	72 75	
Stakes,	68 00	
Sharpening tools,	15 40	
Signs,	35 90	
Travel,	173 50	
Traps, frames and covers,	194 00	
Use of transit,	8 00	
Water pipes,	41 57	
Balch & Rackemann,	592 35	
Olmsted, Olmsted & Eliot,	296 53	
McCusker Brothers,	63,222 31	
William T. Pierce,	11 03	
John H. Hooper,	75 00	
William J. Parker,	75 00	
Andrew Carberry,	1,837 68	
Land:—		
John G. Chandler,	400 00	
Jennie L. Elliott,	350 00	
Walter H. Morton,	1,950 00	
Stillman K. Roberts,	650 00	
Arthur H. Wellman, attorney,	100 00	
Total,		71,850 50
<i>Mystic Valley Parkway.</i>		
Advertising,	\$285 38	
Building fence,	171 33	
Amounts carried forward,	\$456 71	\$74,095 10

Analysis of Payments, etc. — Continued.

<i>Amounts brought forward, .</i>	<i>\$456 71</i>	<i>\$74,095 10</i>	
Canvas,	8 88		
Coal,	189 99		
Carpenter work,	4 80		
Cement,	1,625 55		
Express,	14 40		
Fence wire,	28 61		
Filling pits,	516 64		
Freight,	16 43		
Grates, etc.,	391 07		
Granite,	1,796 25		
Horse hire,	24 50		
Iron piping,	264 10		
Labor,	404 02		
Lumber,	951 03		
Oil,	37 59		
Patterns,	3 40		
Posts,	23 40		
Piping,	14 28		
Photographs,	34 50		
Sewer pipes,	17 00		
Signs,	7 32		
Stove,	11 30		
Stakes,	111 50		
Stones,	1,614 35		
Travel,	125 25		
Teaming,	29 40		
Painting fence,	68 75		
Wood,	1 50		
Charles D. Elliot,	30 00		
N. Matthews, Jr.,	200 00		
Balch & Rackemann,	620 62		
Olmsted, Olmsted & Eliot,	1,297 88		
William T. Pierce,	39 90		
William H. Mague,	32,436 87		
M. Gill & Son,	974 12		
Land: —			
Peter C. Brooks,	7,500 00		
Jane J. O'Hara,	8,000 00		
George E. Smith, attorney,	6,000 00		
Total,		65,891 91	
Labor,	\$9,758 97		
F. S. Goodwin,	615 65		
Olmsted, Olmsted & Eliot,	774 78		
J. H. Stubbs,	200 00		
William T. Pierce,	113 12		
Alice G. Kelley,	191 67		
Mary C. Godvin,	45 00		
George L. Rogers,	200 00		
Advertising,	219 35		
Books,	9 60		
<i>Amounts carried forward, .</i>	<i>\$12,128 14</i>	<i>\$139,987 01</i>	

Analysis of Payments, etc. — Concluded.

<i>Amounts brought forward,</i>				\$12,128 14	\$139,987 01	
Drawing material,	.	.	.	52 60		
Electric light,	.	.	.	38 42		
Hardware,	.	.	.	1 32		
Janitor,	.	.	.	105 00		
Ice,	.	.	.	5 45		
Printing,	.	.	.	4 00		
Map case,	.	.	.	45 00		
Photogravures,	.	.	.	280 37		
Repairs,	.	.	.	30 65		
Rent of offices,	.	.	.	800 00		
Stationery,	.	.	.	127 16		
Stakes,	.	.	.	31 35		
Spikes,	.	.	.	6 00		
Steel tapes,	.	.	.	61 44		
Travel,	.	.	.	221 50		
Telephone,	.	.	.	39 00		
Typewriter,	.	.	.	127 00		
Transits,	.	.	.	232 00		
Washing towels,	.	.	.	6 45		
Wrapping paper,	.	.	.	9 90		
Window shades,	.	.	.	5 38		
Total,	.	.	.		14,358 13	
Total expenditures in						
Series II.,	.	.	.			\$154,345 14

TENTH ANNUAL REPORT

OF THE

MASSACHUSETTS BOARD OF REGISTRATION IN DENTISTRY.

FOR THE YEAR 1896.

BOSTON :
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
1897.

MEMBERS OF THE
MASSACHUSETTS BOARD OF REGISTRATION IN DENTISTRY,
1896.

JOHN F. DOWSLEY, D.D.S., Boston.
E. V. McLEOD, D.D.S., New Bedford.
GEORGE E. MITCHELL, D.D.S., Haverhill.
THOMAS J. BARRETT, D.D.S., Worcester.
DWIGHT M. CLAPP, D.M.D., Boston.

Commonwealth of Massachusetts.

BOARD OF REGISTRATION IN DENTISTRY.

To His Excellency ROGER WOLCOTT, *Governor*.

SIR: — Complying with the provision of section 6, chapter 137 of the Acts of 1887, the Board of Registration in Dentistry has the honor to present to you this its tenth annual report.

The term of Thomas J. Barrett, D.D.S., of Worcester, having expired, Your Excellency reappointed him a member of the Board for three years, and he was duly qualified.

The unexpired term of J. Searle Hurlbut, D.D.S., of Springfield, resigned, was filled by the appointment of Dwight M. Clapp, D.M.D., of Boston, by Your Excellency, and he was duly qualified.

In the retirement of Dr. Hurlbut, on account of ill health, the Board loses one of its original members, who for the last four years has been its president. His years of service have been signally marked by untiring devotion to the duties intrusted to him by the State. He was particularly adapted to the work, an excellent examiner, who always showed remarkable wisdom, fairness and judgment in the discharge of his duties.

At the meeting of the Board, in June, John F. Dowsley, D.D.S., was elected president, and E. V. McLeod, D.D.S., was re-elected secretary.

During the past year, 1896, examinations have been held in June and December. At the June meeting there were 135 applicants, and of this number 87 passed and were given certificates. At the December examination 79 applied, and of these 49 passed and received certificates.

Of those who failed, many had already been before the Board five or six, some seven or eight, times without success. For these re-examinations the law provides no extra fee. This condition of things not only adds to the work of the Board, but also, it will be seen, greatly increases its expense; and in view of this the Board again beg leave to call attention to the fact that the present fee of \$10 is wholly inadequate. Therefore it is recommended that the fee be changed to \$20, and that each unsuccessful candidate, after being re-examined once, be required to pay an additional fee of \$5 for every re-examination. In the opinion of the Board, this would not only be a means of meeting the necessary expenses, but would be a guarantee of earnest endeavor and good faith on the part of every candidate.

In order to facilitate the increased work of the Board, and with a view of better results and the greater proficiency of the candidates themselves, it is recommended that all examinations in theory be conducted in writing, or partly in writing and partly oral, at the discretion and at the option of the Board.

Violations of the law in three cases were brought to the attention of the Board during the year. These were properly complained of and prosecuted in the courts by the regular officers of the law, and each fined \$50 and costs.

The next meeting of the Board for examination of candidates will be held in Boston, June, 1897.

This being the tenth annual report, and as no complete list of registered dentists has been printed since 1888, the Board deemed it most advisable to annex one to this report.

RECEIPTS.

Balance in State treasury Jan. 1, 1896,	.	.	.	\$252 99
Fees for examination, June, 1896,	.	.	.	890 00
Fees for examination, December, 1896,	.	.	.	530 00
			<u> </u>	\$1,672 99

EXPENDITURES.

Expenses to Jan. 1, 1897,	. . . . .	1,130 98
Balance in State treasury Jan. 1, 1897,	. . . . .	<u>\$542 01</u>

We wish to draw attention to the fact that the balance of \$542.01 now in the treasury is not sufficient to pay the salaries per diem, nor repay the actual cash paid out by members of the Board for their personal expenses in attending meetings during 1896, amounting to \$1,234.50.

All of which is respectfully submitted,

JOHN F. DOWSLEY, *President.*
E. V. McLEOD, *Secretary.*

EVANS HOUSE, BOSTON,
DEC. 31, 1896.

LIST OF DENTISTS—REGISTERED TO JAN. 1, 1897.

Abbott, Edw. C.	Ayer, J. F.
Abbott, I. Sumner.	*Ayers, Arthur B.
*Achard, W. C.	Bacon, Henry W.
*Adams, Herbert W.	Baker, H. A.
Adams, J. F.	Baker, George T.
*Adams, Philip W.	Baker, George W.
Adams, Sylvester R.	*Bailey, John W.
Ainsworth, Dan'l W.	Ball, J. Warren.
Ainsworth, George C.	Ball, Willard D.
*Ager, J. Francis.	*Ball, W. E.
*Akins, George H.	Ballou, Henry E.
*Allard, Arthur D.	Baldwin, Robert A.
Allen, C. H.	Bancroft, Fred'k W.
Allen, Chas. P.	Banfield, Fred'k E.
*Allen, Fred W.	Barber, G. F.
Allen, George S.	*Barbeau, Jean B.
Allen, John F.	Barbour, Fred W.
Allen, Marcellus H.	*Barden, G. F.
*Allen, Otis, 2d.	*Barker, Wm.
Allen, Wm. Y.	*Barnard, Francis H.
*Alleyne, Mary E.	Barnard, Geo. M. C.
*Allis, D. Hurlbut.	*Barnay, Karl L.
Ames, Nathan E.	Barnes, Fred'k W.
Andrews, Edwin W.	Barnett, Geo. D.
Andrews, Robt. R.	*Barnicle, D. J.
Andrews, Wm. F.	*Barolet, A. E.
Angler, Edwin R.	*Barrett, Joseph A.
Arnold, E. E.	Barrett, Thos. J.
*Arnold, Eugene E.	Barrett, Wm. O.
*Arnold, Walter H.	*Barrows, Edwin D.
*Arvedson, E. S.	Bartholomew, H. H.
Ashley, N.	Bartholomew, Sam'l B.
*Ashley, Fred M.	Bartlett, Albert H.
Atkins, E. N.	Bartlett, Chas. S.
Atwood, Joseph.	Bartlett, Dares E.
*Audler, George J.	Bartlett, Edwin L.
Austin, Joseph.	Bartlett, Frank D.

LIST OF DENTISTS — *Continued.*

Bartlett, Hiram P.	*Bickell, Fred F.
Bartlett, James W.	Bickell, Joshua K.
Bartlett, John B.	*Bigelow, Lyman F.
Bartlett, Moses K.	*Bill, Clement E.
*Bartlett, Robt. L.	Billings, Geo. A.
*Bartlett, Sidney R.	Billings, John A.
Barton, Earl G.	*Bills, Chas. A.
Barton, Chas. P.	*Bixby, Harry O.
*Barton, B. D.	Black, Duncan C.
Bassett, Ralph E.	*Blaisdell, E. C.
Bastian, Fred'k S.	Blake, J. Edgar.
Bastian, David P.	*Blake, Mary E.
Bates, Edw. N.	*Blake, Ralph V.
Bates, Fred'k A.	Blethen, A. C.
Bates, Geo. A.	Bliven, C. Frank.
Bates, Geo. C.	Blood, Thos. S.
Bates, Wm. M.	Boardman, Waldo E.
Batchelder, John H.	*Boitel, P. H.
Batchelor, Andrew A.	Bond, W. H.
Battles, W. P.	*Booker, Warren E.
Baxter, Wm. H.	*Borton, Henry Y.
*Beale, W. E.	*Bosworth, G. W.
Beals, Frank D.	*Bourque, A. H.
Beals, Joseph.	Bouve, Allston G.
Beaman, Wm. W.	*Bowen, John J.
*Beane, John H.	Bowles, Chas. E.
Beard, Chas. F.	Bowthorpe, Sam'l T.
*Beard, Geo. F.	*Boyd, Herman J.
*Beckman, H. G.	Boyd, Harvey W.
Bell, John.	Boyden, Edw. A.
*Bellefleur, Joseph L.	*Boylston, Joseph.
*Belliveau, J. B.	*Boynton, Fred'k A.
Belliveau, Siegfroi.	*Boynton, Geo. E.
*Bellows, John M.	*Boynton, Walter I.
*Belyea, Fred A.	Bowers, Geo. A.
*Belyea, Harry E.	Bowers, Clarence H.
Bement, John R.	*Bowers, Urban B.
Bemis, A. A.	Bowers, Horace A.
Bennett, Geo. L.	*Brackett, Chas. A.
*Bent, Earnest.	Brackett, Elmore F.
*Berry, Chas. W.	Bradbury, Edwin P.
Bevington, F. W.	Bradley, John P.
Bibber, Edw. F.	Bragg, Fred'k A.

LIST OF DENTISTS — *Continued.*

Brande, C. D.	*Buckley, Melville B.
Brande, Malon E.	Buffington, Fred'k W.
Brandow, Frank W.	Bulger, Augustine J.
Bragdon, Chas. E.	*Bulger, Joseph M.
Branigan, Edw. W.	Bullock, Alanson B.
*Breck, Henry T.	Bullock, Chas.
Breed, Louis S.	Burbank, Franz D.
*Brewster, Leonard E.	Burdick, J. Frank.
*Bridge, J. C. F.	Burghardt, John M.
Briggs, Edw. C.	Burnham, Albert W.
Briggs, Edgar A.	*Burnham, A. S.
*Briggs, Chas. P.	*Burbridge, Frank E.
*Briggs, Jason C.	*Burbridge, Hereward.
Brigham, Dan'l T.	*Burt, Geo. S.
*Brigham, John P.	Burtchaell, Peter E.
Brigham, Henry Q.	*Bussey, S. Randall.
*Brigham, Percy H.	Buswell, Chas. A.
Brigham, Walter J.	*Bugbee, Nathan P.
*Bristol, Thos. D.	*Burley, Josiah D.
*Brock, Karl S.	Burpee, H. T.
Brock, Edwin H.	Butler, George.
*Brooks, Marcus F.	Butterfield, Edwin B.
*Brouillet, G. A.	Buxton, Chas. A.
*Brown, Alpheus R.	*Caffey, Wm. H.
Brown, Arthur T.	*Cahill, Thos. P.
Brown, Benoni S.	*Callaway, Rich'd B.
*Brown, E. P.	*Campbell, M. S.
Brown, Edmund R.	*Campbell, John G.
*Brown, Ellsworth N.	*Cannon, Chas. H.
Brown, Eugene M.	Capen, G. F.
Brown, Frank F.	*Capwell, C. G.
Brown, Fred'k E.	*Carr, Clarence A.
*Brown, Fred'k H.	*Carr, Richard B.
*Brown, Godwin M.	Carlton, Francis D.
Brown, J. Milton.	*Carpenter, Chauncy M.
Brown, John A.	Carter, John W.
Brown, R. D.	Carville, Zenas V.
Browne, A. L.	Cassidy, Francis E.
Browne, Proctor K.	Cate, Albert F.
*Bryant, Edw. S.	*Caulfield, P. A.
Bryant, Henry W.	Chandler, Bartlett B.
*Bryson, Geo. S.	*Chandler, J. B.
Buck, Edgar J.	Channing, Wm. H.

LIST OF DENTISTS—*Continued.*

Channing, Wm. R.	*Coleman, Andrew D.
Chapman, John W.	Colgan, A. J.
*Chapman, F. R.	Collins, H. J.
*Charles, F. A.	Collins, Hiram.
*Chase, A. H.	Collins, J. Robert.
*Chase, Arthur L.	*Comins, A. Olin.
*Chase, C. E. B.	Comins, Geo. S. H.
Chase, Henry E.	*Constantineau, Geo.
*Chase, H. P.	Cooke, F. A.
Chase, Milton.	Cooke, Geo. L.
*Chase, Stephen F.	Cooke, Geo. P.
Chase, Stephen H.	Cooke, E. Ward.
Cheney, Clarence J.	Cooke, Henry P.
*Chernatoosky, Louis.	Cooke, James O.
*Chevigny, Henry H.	Cooke, Samuel W.
Child, J. T.	Cooke, Wm. P.
Childs, Jacob.	*Cookingham, Geo. T.
Chivers, Thos. H.	Coolidge, John B.
Chivers, Roland M.	*Cooling, Wm. S.
*Chute, Ernest H.	*Copeland, Edw. E.
Clapp, Dwight M.	*Copeland, P. R.
Clapp, H. W.	Corken, Chas. H.
*Clark, E. N.	Cote, Frank N.
Clark, Geo. R.	Couch, Harley J.
Clark, Hobart.	Cowan, Alex. B.
Clark, Louis L.	*Cowell, Edw. J.
Clark, R. H.	Coxeter, John J.
Clark, Rufus O.	Crane, Chas. W.
*Clark, S. W.	*Cregan, Wm. H.
Clark, Wm. D.	Crittenden, Geo. W.
Clements, Thos. W.	Cross, Cyrus W.
*Cleary, James.	Cross, Elroy F.
Clifford, C. T.	*Cross, H. D. W.
Clifford, Henry M.	Crowell, Fred J.
*Clinch, Wm. C.	*Cuff, Thomas F.
Clock, F. H.	*Cummings, Chas. O.
*Coar, Firman W.	Cummings, John R.
Coburn, Harry W.	*Cummings, Wm. H.
*Cochel, Chas. A.	*Cunard, John S.
Cochran, Robt. H.	*Currie, Herbert D.
*Codman, Benj. H.	Currie, Willard A.
Codman, J. T.	*Currier, Edw. M.
Coffin, Alex. G.	*Currier, Walter B.

LIST OF DENTISTS — *Continued.*

*Currier, Walter J.
 *Curtice, Willard E.
 Curtis, Samuel H.
 *Cushing, Fred.
 Cutter, Harry E.
 Cyr, Joseph.
 *Dally, Henry C.
 *Damon, Fred N.
 Damon, Frank A.
 *Daly, J. F.
 Daly, James H.
 Daly, James M.
 Daly, M. Ordway.
 Daniels, Louis.
 *Daniels, Thos. M.
 *Daniels, Wm. N.
 Darling, Frank F.
 *Darling, H. G.
 *Darling, Victor E.
 Da Silva, Louis.
 Davenport, A. F.
 Davenport, Ed. S.
 Davenport, Joseph N.
 *Davenport, Melvin E.
 *Davenport, R. M.
 Davenport, W. H.
 *Davies, Wm. V.
 *Davis, Chas. H.
 *Davis, Edwin B.
 Davis, Edwin E.
 *Davis, Jas. W.
 *Davis, Robert I.
 Day, Alphonzo M.
 Day, Edward.
 *Day, Geo. W.
 Dearborn, Chas. E.
 De Couagne, Amedee.
 *Delabarre, F. A.
 Delano, Robt. T.
 Delano, Walter H.
 Demers, Louis D.
 Dennett, Geo. A.
 Dennett, Herbert E.

 Dennett, J. P.
 *Derby, Albert J.
 Derby, Pardon.
 Devereaux, W. J.
 *Devlin, Jas. W.
 *Dickerman, Frank R.
 Dickerman, C. R.
 Dickerman, Wm. T.
 *Dickinson, Dwight W.
 *Dickinson, Edw. B.
 Dickinson, John D.
 Dietra, E. C.
 Digum, M. A.
 Dillingham, Geo. E.
 Dixon, E. J.
 *Dixon, Edwin H.
 *Dixon, Geo. W.
 Dixon, Rufus E.
 Dodge, Clarence L.
 Dodge, James N.
 Dodge, Wm. A.
 Donham, Geo. E.
 Douglass, Benj. H.
 Downs, Wm. H.
 Dowsley, John F.
 Dowsley, Thomas M.
 Dox, Geo. W.
 Doyle, Henry C.
 Drake, Willard L.
 Draper, Harry S.
 Drew, George R.
 Drew, Thos. B.
 Duddy, Wm. H.
 Dudley, Albion M.
 Dudley, Edmund B.
 Dudley, Jonas G.
 *Duffy, Albert J.
 *Dunton, Walter L.
 Dutton, Lorenzo B.
 Dwyer, Eugene G.
 *Eagan, Owen J.
 Eames, Geo. F.
 Eaton, Edwin A.

LIST OF DENTISTS — Continued.

•Eaton, John H.	Felton, John W.
•Eaton, Tilly H.	Fenderson, Lory B.
Eayrs, Chas. G. A.	Fenton, Michael J.
•Eddy, Irving P.	Fenn, George L.
Edes, Lewis M.	•Fernald, Adelbert.
Edgerly, D. W.	•Ferris, James M.
Edson, Robt. C.	•Ferry, Edmund J.
Edwards, W. Hadley.	Fesler, Frank J.
Edwards, W. P.	•Field, Geo. W., Jr.
Effrone, Lewis A.	Fielding, John W.
•Egan, C. A.	Fillebrown, Thos.
•Egan, Henry M.	Filoon, H. H.
•Ehni, Robt. F.	Finney, Edgar W.
•Ehni, Wm. H.	•Fisher, Alex. H.
•Eldred, Arthur W.	Fiske, Jeremiah.
Eldridge, Jerrie A.	Fitts, G. B.
Ellinwood, Eugene.	Fitzpatrick, James R.
Elliott, Geo. B.	Flagg, Algernon S.
Elliott, Wilmer S.	Flagg, Geo. H. P.
Elliott, Wm. L.	Flagg, John S.
Emery, Albert T.	•Flanagan, Andrew J.
•Emery, John W.	Flint, Edmund G.
Emery, Sam'l E.	•Flynn, Edmund F.
•Emerson, Frank S.	•Flynn, Michael W.
Emerson, Geo. F.	•Flynn, Wm. M.
Emerson, Geo. W.	•Fogg, Fred. S.
Emerson, Homer.	Fogg, Ralph.
England, G. B.	Follansbee, M. W.
•Ennis, Edward.	Folsom, John S.
Ensworth, Chas. R.	Foltz, J. Francis.
Estabrook, C. E.	•Forbes, John W.
Estabrook, Chas. W.	Forbes, Winthrop W.
Estabrook, D. F.	•Ford, J. J.
•Ewing, Jas. A.	Fortier, A. J.
•Fauteaux, H. G.	Foss, Lewis T.
•Farris, W. E.	Foss, Willis.
Farley, Jas. P.	•Foster, Chas. E.
•Farnham, Wm. G.	Foster, Edw. W.
•Farrington, Edwin L.	Foster, Wm. B.
Farrington, Fred L.	Fowler, L. W.
•Faunce, Walter J.	Fox, Chas. A.
Faxon, Fred'k S.	Frazer, Alfred.
Fellows, Horace E.	Freeman, Fred.

LIST OF DENTISTS—*Continued.*

French, Alfonzo E.	Gilman, Eugene C.
French, Chas. S.	*Gilman, Harry S.
French, Theodore W.	Gilman, W. F.
*French, Walter E.	Gilmore, F. D.
*Frost, Alfred A.	Gilson, A. H.
Frost, Edw. E.	Gilson, F. Earland.
Furfey, James A.	*Gleason, Ernest E.
Gabeler, Addison W.	*Gleason, Horace F.
Gabeler, Henry H.	*Glidden, John E.
Gabeler, Wm. A.	*Goldthwaite, Geo. H.
*Gaffey, Jos. M.	*Goldsmith, A. A.
Gage, Fred F.	Goodrich, E. M.
Gage, Herbert H.	*Goodwin, W. I.
Gagnon, Arthur J.	*Goodrich, Chas. A.
*Gallup, Jennie H.	Gordon, Allen B.
*Gallup, Mary E.	Gordon, Alex. A.
Gamage, Olonzo A.	Gorham, Ralph.
*Gammon, Guy N.	*Gould, Arthur W.
Gammon, Nathaniel.	Gould, John W.
Gamwell, Jas.	*Gower, Frank L.
Gardner, D. W.	Grant, Geo. F.
Garland, Kirk A.	*Gray, Geo. R.
Gates, Chas. S.	Gray, Alfred E.
Gay, Wm. F.	Graves, Fred P.
Gaylord, E. D.	Graves, J. E.
Gaylord, Henry A.	Greeley, Chas. R.
Gerry, Arthur C.	Greeley, L. L.
Gerry, George H.	*Green, Arthur W.
Giblin, Thos. J.	Green, Geo. E.
Gibson, Geo. B.	Green, Wm. B.
Gifford, Benj. D.	*Greene, Arthur Y.
*Gifford, Miranda B.	Greene, Chas. R.
*Gilbert, B. C.	*Greenwood, Geo. T.
Gilbert, Chas. H.	Griffin, Daniel.
*Gilbert, Guy W.	*Griffin, S. Henry.
Gilbert, Norman W.	*Griffith, Harry C.
*Gilbert, Wm. H.	*Grimes, Samuel W.
*Gillander, Geo. H.	Grover, Chas. W. S.
*Gillanders, Walter.	Grover, James M.
Gillis, F. Herman.	Gullsham, Henry W.
*Gillon, Edw. F.	Gulliver, T. H.
*Gillon, John B.	Gulliver, Wm. L.
Gilman, Chas. L.	*Hadley, Amos I.

LIST OF DENTISTS — *Continued.*

Hahn, Sidney G.	Hatch, Frank A.
Hakes, C. H.	*Hathaway, Edw. S.
Hale, John E.	Hawes, Nathaniel W.
*Halevy, I. H.	*Hayden, Thos. B.
*Haley, Harry W.	Hayden, W. W.
*Hall, Andrew F.	Hayes, Jos. A.
*Hall, Charles.	Haynes, W. A.
Hall, Clark F.	*Haynes, Harry M.
Hall, George O.	Hazelton, John W.
Hall, Oliver W.	Heald, Benj. F.
Hall, Stephen A.	Helah, Chas. E.
*Hallett, Theodore.	Hemmenway, Fred'k M.
Ham, Chas. W.	Hemmenway, James.
Ham, Samuel F.	Henderson, Jas. B.
Hamlin, Edw. L.	*Henry, Edw. E.
Hamilton, Chas., Jr.	*Henry, Helen M.
Hamilton, Harry F.	Henry, Stephen.
*Hamm, Alex. J.	*Hervey, Wm. I.
Hamm, Edward.	*Hews, Clarence.
*Hammett, Chas. W.	Hichborn, Herman G.
*Hammond, Frank I.	*Higgins, Chas. E. H.
Hanes, C. H.	*Higgins, M. P.
*Hanson, A. E.	Hill, Aaron, Jr.
*Hanson, Winfield E.	Hill, Alfred S.
*Harding, Frank H.	Hill, Elmer E.
Harding, Geo. L.	Hill, Wm. D.
Harding, Horace.	*Hill, Wm. T.
*Hardy, C. H.	Hills, Henry M.
*Hardy, H. W.	*Hinckley, Edw. C.
*Hardy, John R.	Hitchcock, Edw. B.
Harriman, Geo. B.	Hitchcock, J. Evarts.
Harrington, Daniel G.	Hitchcock, W. S. D.
Harkins, Daniel G.	Hodgdon, C. W.
Harris, Chas. H.	*Hodgkins, Harvey L.
Harris, Edwin L.	*Hogan, Jas. D.
*Harris, Frank P.	Holbrook, Jos. E.
Harris, John L.	Holden, C. S.
Hart, Edwin W.	Holden, Daniel.
Harvey, Fred'k H.	*Holden, Geo. M.
Harvey, Mason P.	*Holder, Jas. P.
Harwood, Geo. F.	*Holmes, E. Proctor.
Harwood, Chas. A.	Hollace, N. E.
Hastings, Henry O.	Holland, Allen J.

LIST OF DENTISTS — *Continued.*

Hollis, Wm. H.	*Hunter, R. W.
Hopkins, Edw. E.	Huntington, Theodore G.
Hopkins, Fred'k S.	*Huntley, Carroll K.
Hopkins, Sam'l A.	Hurd, Geo. L.
Hood, Clarence O.	Hurlbut, Cornelius S.
*Hooker, Sara.	*Hurlbut, Cornelius S., Jr.
Horn, Frank E.	Hurlbut, J. Searle.
Horne, Robert F.	Huse, James N.
*Horsfall, Arthur.	Hussey, David G.
Horton, A. E.	Hutchinson, Chas. E.
*Hosley, H. E.	Hybennet, Napoleon.
*Hosmer, Ernest.	Ingalls, Daniel B.
Hosmer, Thos. B.	Ingraham, Shirley C.
Houghton, Chillon.	*Irish, Geo. O.
Houghton, Warren N.	*Jackson, Arthur.
Houle, Joseph H.	*Jackson, John H.
House, Elmer E.	Jacobs, Franklin.
*Houston, Wm. M. P.	Jenks, Arthur E.
Howard, A. H.	Jennison, Geo. H.
Howard, A. W.	*Jessurum, Moses.
*Howard, Wm. R.	Jewell, Albert B.
*Howe, Allen.	Jewett, John P.
*Howe, Edw. D.	Jewett, Wm. A.
Howe, Geo. W.	Johnquest, Chas. H.
Howe, Leonard N.	*Johnson, Ernest L.
Howe, Oscar.	Johnson, Henry E.
Howe, Seth W.	Johnson, Lewis L.
Howland, Asa A.	Johnson, Newell D.
Howland, A. W.	Johnson, Wm. L.
Howland, F. Harris.	Johnson, W. O.
Howland, S. Oscar.	*Johnston, Frank B.
Hovestadt, Julius F.	Jones, Arthur C.
Hoyt, Claudius.	Jones, H. Almon.
Huckins, D. T.	Jones, John R.
Huckins, E. W.	Jones, Wm. H.
*Hudson, F. W.	*Jones, Wm. R.
Hudson, W. P.	*Jordan, Edw. L.
Hull, Arthur C.	Joy, Francis B.
*Hull, Roscoe H.	Judd, Orville W.
*Hulme, Albert E.	Keach, Chas. H.
Humphrey, James.	Keep, Chas. M.
*Hunt, Walter J.	*Kelley, Patrick I.
Hunter, Frank W.	*Kelley, Philip P.

LIST OF DENTISTS — *Continued.*

Kelley, Silas H.	Laurie, Peter.
Kelley, Wm. J.	Lawrence, Samuel.
*Kelly, J. P.	Lawrence, Wm. H.
*Kelly, Wm. S.	Lawton, C. P.
*Kenney, John W.	Leach, Chas. W.
Kendall, W. G.	Leach, E. C.
Kendrick, F. H.	Leach, E. G.
Kendrick, Henry C.	Leach, Jonathan S.
Kennedy, Francis M.	Leach, Valette W.
Kennedy, John.	Leavitt, Joseph.
Kennedy, W. D.	Leavitt, Wm. P.
Kershaw, Chas. A.	Le Duke, Edw.
*Ketcham, A. H.	Le Duke, Geo. W.
*Kettenbell, A. T.	*Lee, Thos. J.
Keyes, Atwood B.	*Lee, Geo. A.
Keyes, Frank W.	Le Gro, Lester B.
*Keyes, John W.	Lelch, Wm.
Kidd, Fred O.	Leland, Frank A.
Kidder, Jas. H.	Leonard, Bradford G.
Kidder, Wm. N.	Leslie, Chas. A.
Kief, Wm. H.	Lester, Wm.
Kimball, Luther G.	*Lesure, Wm. A.
*King, Thos. J.	*Lett, Isidore.
*King, John S.	Lewis, Arthur E.
Kingman, Gardner M.	Lewis, Fred'k.
*Kinsman, Chas. T.	Libbey, Wilfred W.
Kinsman, Edgar O.	Libby, Henry F.
*Knapp, Walter E.	Lietropp, Knut J.
Knight, Joseph K.	Lima, Joseph M.
Knox, Wm. E.	*Lincoln, Edw. H.
Kuhl, F. G.	*Lindstrom, C. R.
*Lacaille, C. W.	*Littig, M. D.
Lamb, Hiram O.	Litch, Ebenezer T.
*Lamere, A. J.	*Little, Chas. B.
Lamkin, Walter M.	Livermore, Aaron H.
*Lamson, Edwin F.	*Livingston, Joseph E.
*Lamson, Frank E.	Locke, Fred A.
*Lamson, Louis E. B.	*Loizeux, Jean J.
Lang, Cyrus T.	Long, Sam'l N.
Lanman, John M.	Loveland, F. A.
*Langdon, Wm. H.	Loveland, Timothy O.
Laskey, Philip B.	Lowe, Edw. A.
Lassoude, Calvin N.	Lowe, Geo. A.

LIST OF DENTISTS — *Continued.*

Lowe, R. M.
 *Luce, Chas. E.
 Luce, Zenas R.
 *Luttrupp, Sverker.
 *Lynde, Forrest H.
 Lyon, Wm. A.
 *Lyons, Fred'k W.
 *Macdonald, J. F.
 Macdonald, Wm. L.
 MacFarland, R. O.
 MacFarlane, Francis J.
 *MacKinnon, John R.
 *Maeder, Fred'k E.
 Magee, Francis D.
 Magoon, Chas. H.
 *Maguire, Geo. E.
 Mair, Arthur C.
 Mallery, Hamlin M.
 *Maltby, M. M.
 Manchester, Asa L.
 *Manchester, Daniel L.
 Manders, Robt. F.
 Manker, Lewis A.
 Mann, Henry E.
 Mann, Wm. W.
 Manning, Joseph.
 Manter, Geo. F.
 *Marsh, Wm. R.
 Marshall, Frank L.
 Marshall, Geo. L.
 *Marshall, N. S.
 Marshall, Simeon F.
 *Marshman, Edw. G.
 Marston, Chas. E.
 *Martin, George.
 *Martin, Jas. F.
 *Martin, N. R.
 *Marven, Edgar W.
 *Mason, Geo. L.
 Mason, John L.
 *Massell, Joseph.
 *Masu da Kotai.
 *Matthews, Edw. W.

*Mayers, Frank R.
 *Mayers, Geo. M.
 Maynard, Chas. A.
 Maynard, Chas. H.
 Mayo, Fred'k M.
 Mayo, Uriah K.
 Maxfield, Geo. A.
 McCollum, Frank G.
 McConnell, Chas. W.
 *McCue, John F.
 *McDermott, C. R.
 McDonald, Chas. F.
 McDonald, Wm. F.
 McDonald, Wm. L.
 McDougal, Sam'l J.
 McGregor, John.
 *McGinley, C. A.
 *McGown, Wilson J.
 McGovern, Edw. J.
 *McGovern, J. T.
 *McIntire, Chas. E.
 *McKay, Gunden R.
 *McKee, J. Atkinson.
 McKenney, A. S.
 *McLaughlin, J. J.
 McLean, Geo. T.
 McLeod, Eugene V.
 McMahon, T. R.
 *McMeekin, R. J.
 McNally, E. T.
 McQuade, J. H.
 Mead, Wm. F.
 *Meader, Fred'k E.
 Meekins, Thos. W.
 Meriam, Horatio C.
 *Mercer, Chas. J.
 *Merrigan, Wm. H.
 *Merrill, A. H.
 Merrill, Fred'k A.
 Merrill, Wm. W.
 Methot, Ebens.
 Mickel, Augustus.
 Mickel, Orin E.

LIST OF DENTISTS—*Continued.*

Middleton, Jas. E.	*Nealis, Edwin J.
Miett, Francis H.	Neall, Jos. M.
*Miett, Norry.	*Neals, S. C.
Migneault, Sam'l.	Negus, Darius F.
Miles, Marshall W.	*Nelson, Chas. C.
Miles, Waldo F.	Nelson, Everett M.
Millard, Simeon L.	Nelson, Martin O.
Millen, Wm. A.	Nesbett, Fred'k B.
Miller, Henry M.	Newell, Geo. H.
*Miller, R. B.	Newhall, Alvah T.
*Miller, R. M.	*Newland, Geo. H.
Milligan, Wm.	Newton, Wm.
*Milliken, Richard D.	Newton, Wm. H.
Mills, Chas. F.	*Nichols, P. P.
*Mills, John A. D.	Niles, Edw. S.
Miranda, Isaac R.	Niles, Jas. P.
Mitchell, Geo. E.	Nims, A. J.
Mitchell, T. M.	Nims, Francis E.
*Mitivier, O. S.	*Noble, Clarence M.
*Moffatt, R. T.	Noble, Lester.
*Montgomery, E. M.	*Noll, Albert W.
*Mooney, Jos. T.	Norcross, C. H.
*Moran, Thos. H.	*Normand, Edwin F.
Morgan, Newton.	Noyes, Geo. E. L.
*Moriarty, Jas. T.	Noyes, Wm. H.
Moriarty, Jos. H.	Noyes, Wm. P.
*Moriarty, Jas. W.	Nute, V. D.
*Moriarty, Patrick W.	Nye, Alex. G.
*Moritz, R. C.	*Nye, D. B.
Morrow, Herbert J.	*Ober, Etta M.
Morse, L. M.	Ober, Fred. A.
*Morton, Frank S.	*Ober, H. Ben.
Mudge, Arthur.	*O'Brien, Henry C.
Mulloy, Jas. J.	O'Brien, Jas. E.
*Munroe, Chas. E.	*O'Connor, Timothy J.
*Munroe, Chas. M.	O'Donnell, Thos.
*Munsell, Wm. H.	*O'Donnell, S. E.
Murless, Daniel.	O'Halloran, Wm.
Murphy, Chas. M.	*Oldham, Arthur J.
*Murray, E. Ernest.	*O'Leary, Wm. C.
*Murray, Wm. G.	*O'Malley, W. F.
*Nason, D. A.	O'Neill, John F.
*Neal, C. A.	Ongley, Chas. E.

LIST OF DENTISTS — *Continued.*

O'Reilley, P. T.	Pemberton, Jas.
*Osgood, Arthur H.	Pendleton, Edw. B.
Osgood, J. M.	Pepin, John V.
Osgood, H. D.	Pepin, W. H.
*Owen, Hugh.	Percival, Benj.
Packard, J. E.	*Percival, Benj. W.
Packard, J. Willard.	*Percival, F. W.
Page, Edw.	*Pero, Albert E.
Page, Henry L.	*Peront, Joseph.
*Page, Ernest H.	Perkins, Charles E.
Page, Washburn E.	*Perkins, H. M.
Paige, Onias S.	Perley, Chas. W.
*Palmer, Edw. J.	Perrin, Edw. A.
*Palmer, Geo. B.	Perrin, Frank.
Palmer, Jos. W.	*Perry, Fred'k A.
Palmer, Thos.	*Perry, Geo. B.
Papineau, Augustus.	Perry, Joseph C.
Parker, Aaron H.	*Peters, Wm. L.
Parker, David S.	Pettingill, Joel M.
Parker, Henry H.	Pevey, Benj. M.
*Parker, Horace J.	Pevey, Chas. K.
Parker, Leland J.	Phelps, Homer A.
Parker, Levi.	*Phillips, Benjamin A.
*Parker, Oswald A.	*Phillips, Percival.
Parker, Wilbur B.	Pierce, Chas. B.
*Parsons, Frank R.	*Pierce, M. E.
*Parsons, Harry S.	Pike, Edwin R.
Partridge, Chas. W.	*Pilling, Fred.
*Patch, John W.	*Piper, Chas. N.
Patten, Chas. C.	*Piper, Henry H.
*Patterson, Daniel.	Piper, Jas. R.
*Patterson, James.	Poirier, Louis D.
*Paul, Joseph T.	Pomeroy, Geo. H.
*Payne, Geo. H.	Pomeroy, Irving H.
Peabody, Dan'l D.	Pomeroy, Wm. H.
*Peach, Harry R.	*Pomfret, John W.
Peach, P. H.	*Pond, Chas. G.
*Pearman, Wm. S.	Pond, Metcalf E.
Pease, Jas. E.	Pond, Virgil C.
Pease, Geo. F.	Porter, David T.
*Pease, Oliver.	Porter, Jesse.
Peatfield, John I.	*Porter, Percy M.
Peirce, Geo. F.	Porter, Warren.

LIST OF DENTISTS — *Continued.*

*Post, Peter J.	*Reynolds, Annie F.
*Potter, James S.	Reynolds, Wilbur A.
*Potter, J. Francis.	Rice, Frank R.
Potter, Marshall A.	Rice, Willard W.
Potter, Wm. H.	Rice, William.
*Povey, D. Russell.	Richards, E. Osgood.
Powers, Edw. S.	*Richards, Russell A.
*Powers, Jesse B.	*Riley, John F.
Powers, Robt. M.	Riley, Judson.
Pray, Jas. E. S.	Ring, Sam'l E.
Pray, Mark W.	Robbins, Jesse.
Pray, M. Wm.	Roberts, Harry R.
Preston, Alonzo F.	Roberts, Wm. L.
Preston, Nathaniel E.	Robie, S. S.
Preston, H. F.	Robinson, Edwin S.
Provan, H. F.	Robinson, Elmer S.
Provan, Walter S.	*Robinson, Fred'k A.
Puffer, Loring W.	Robinson, Fred'k M.
Purdy, F. W.	Robinson, Julian D.
Purdy, Warren H.	Robinson, Thos. W.
Putnam, Geo. L.	Roby, Fred F.
Quackenbos, E. J.	*Rogers, Alfred P.
*Quigly, Sam'l.	Rogers, Edw. T.
Quinn, Jas. E.	*Rogers, Geo. G.
*Quinn, M. W.	Rogers, Frank.
*Quinn, Thos. E.	Rogers, Oliver P.
Rafferty, Jas. J.	Rogers, Wm.
Rand, M. K.	*Rolfe, Edw. D.
Randall, Gilbert E.	*Roller, O. P.
*Ray, John Z.	Rollins, Wm. H.
Raymond, Geo. A.	*Rombough, Wm. L.
Read, Jas. H.	*Rose, Henry E.
*Readio, Frank M.	Ross, A. M.
*Reardon, J. P.	Ross, Chas. E.
Reed, Artemus W.	Ross, James.
Reed, Mrs. Augusta E.	*Ross, Thos. K.
Reed, G. G.	*Rounds, Fred. L.
Reed, Guilford S.	Roussel, Emery A.
Reilly, James A.	Rowe, Hiram D.
*Reilly, John L.	*Rowe, Walter E.
*Reilly, W. F. B.	*Rowe, Wm. A.
*Reilly, Wm. T.	*Runals, Ralph F.
*Renaud, X. M. P.	Russell, H. F.

LIST OF DENTISTS — *Continued.*

Russell, Nathan B.	Shuebruk, Richard.
Russell, W. W.	Shumway, Thos. D.
Ryan, Jas. J.	Silva, Sam'l S.
Salles, Fred'k M.	Simmons, Edwin H.
Sanborn, J. F.	*Simpson, Geo. E.
Sanborn, Sherman H.	*Simpson, Wm. H.
Sanborn, Wm. A.	Simson, James K.
Sanderson, H. L.	Slack, W. F.
*Sanderson, Harlan L.	Slayton, George S.
Sargent, R. C.	*Sleeper, Benj. F.
Saunders, Sam'l K.	*Sleeper, Geo. A.
Savage, Geo. E.	*Smith, Arthur G.
Savage, Geo. H.	*Smith, Chas. E.
Savary, W. P.	Smith, Chas. H.
Saville, Alonzo F.	Smith, Daniel H.
Saville, N. E.	Smith, Edw. C.
Sawyer, A. J.	Smith, Eugene H.
*Sawyer, Fred'k A.	Smith, Henry A.
Sawyer, Jos. W., Jr.	Smith, Horace C.
Sawyer, Wm. R.	*Smith, John J.
*Scolley, John W.	Smith, Lillian G.
*Scott, John Stephen.	Smith, M. C.
*Scott, L. W.	Smith, Otis F.
Sellers, Wm.	Smith, Willis F.
Sears, W. H.	Snow, Arthur E.
*Sharp, Wm. F.	*Snow, Wallace.
*Sharpe, F. B.	Snyder, Chas. E.
*Shatswell, Harry K.	Snyder, David D.
Shattuck, Edwin L.	Soule, Chas. I.
*Shaw, Albert A.	Soule, Geo. W.
*Shaw, Dewitt C.	Soule, P. W.
Shaw, J. Wesley.	Soule, Wm. D.
Shaw, Sam'l J.	Southwell, R. W.
*Shaw, Wallace F.	*Spencer, Harry C.
Shepard, Luther D.	*Spencer, T. Frank.
Shepherd, Jas.	Spencer, Wm. H.
Sherman, Cyrus T.	*Spofford, Herbert E.
*Sherman, E. T.	*Spooner, F. F.
Sherman, John M.	Sprague, Chas. L.
Shockley, A. L.	Sprague, Frank E.
*Shorey, Elbridge A.	Sprague, Fred L.
*Shorrocks, Arthur.	Springall, Thos. J.
Shubert, Frank A.	Stanley, Ned A.

LIST OF DENTISTS — *Continued.*

Stansfield, Howarth.	*Swasey, Wm. P.
Stanton, J. E.	Sweet, Wm. L.
Starbuck, Edw. P.	Swett, L. M.
Starbuck, Walter J.	Taber, Geo. A.
Starbuck, Wm. C.	Taft, Chas. H.
Stebbins, E. A.	Taft, Ezra F.
Stebbins, Edw.	*Taft, Geo. L.
Stebbins, Leonard S.	*Talbot, Edw. S.
*Stedman, Frank E.	Taylor, Alfred A.
*Stephens, Winston.	Taylor, Eugene S.
Stevens, Edgar F.	Taylor, Everett M.
Stevens, J. R.	*Taylor, G. Fulton.
Stevens, Oscar H.	*Taylor, Frank T.
Stevens, Stephen G.	*Taylor, Jos. L.
Stevens, Walter L.	*Taylor, Wesford M.
Stevens, Ward B.	Tarr, Chas. B.
Stetson, John T.	Temple, Theron W.
Stewart, Jas. H.	Tenney, A. W.
Stickney, Edwin D.	Tenney, Adolphus R.
Stiles, Geo. A.	*Tessler, Geo. O.
Stillman, Harrison T.	Thatcher, Geo. A.
Stockwell, C. T.	*Thayer, Lucius K.
Stockwell, Frank H.	Thayer, Sam'l W.
Stoddard, Arthur H.	Thomas, Edwin A.
Stoddard, Bertrand B.	Thompson, Edmund J.
Stoddard, Ernest C.	Thompson, Edwin J.
*Stoddard, Geo. E.	Thompson, J. A.
Stone, H. N.	Thompson, Julius.
Stone, J. L.	*Thompson, W. C.
Stone, Wm. F.	Thorndike, Jas. S.
Stowe, Wm. H.	*Thornton, B. H.
Stowell, Sidney S.	*Tierney, Alex.
Strawn, David G.	Tinkham, Chas. E.
*Streeter, W. H.	*Titcomb, C. D.
Stroat, Byron H.	*Tolman, Leon C.
*Strohn, Emil.	Tolman, Lorenzo F.
Sugat, W. P.	Toombs, J. Everett.
*Sullivan, Jos. E.	Towle, Geo. F.
*Sullivan, T. P.	Towne, Chas. S.
*Sutherland, J. F.	Towne, Henry G.
Swasey, Benj. A.	*Towne, W. E.
Swasey, Oscar F.	Townsend, Almon F.
Swasey, Walter W.	Townsend, Edgar F.

LIST OF DENTISTS — *Continued.*

Tracy, E. S.	Ward, Wm. G.
Tracy, N. K.	Warner, Mrs. E. M.
Traphagen, Geo. W.	Warren, Chas. E.
*Triggs, Frank J.	*Warren, Herbert H.
*Tripp, Jerome P.	*Warren, Lewis L.
*True, Geo. L.	*Wasgatt, O. E.
Truell, Hiram E.	Washburn, Christian.
Tuck, Geo. O.	Washburn, O. F.
*Tufts, John B.	Watkins, Henry W.
*Tullock, Geo. L.	Weatherbee, Isaac J.
Tuttle, Clarence E.	*Weaver, A. W.
*Tuttle, W. E.	Weaver, Fred A.
Underwood, Clarence B.	Webb, Edgar.
Upham, Henry L.	*Webber, Jas. H.
Upham, Robt. H.	Webber, Wm. H.
Vadnais, Edmond E.	*Weber, S. D.
Van Elderen, J.	Weeks, Edw. J.
Veo, Chas. H.	Weeks, Frank H.
*Veo, L. N.	*Welch, W. J.
Verge, Wm. J.	Wells, A. L., Jr.
*Vesper, Chas. P.	Wells, Frank E.
Vinall, Geo. A. W.	*Wengenroth, Adolphus.
Vincent, J. J.	*Wetherell, Cyrus W.
*Vinton, Sherman E.	*Wentworth, James P.
*Volk, R. W.	Wentworth, Geo. M.
*Von Betzen, John.	Wentworth, Roscoe L.
Waining, Freeman E.	Werner, Julius G. W.
Walt, Herbert C.	Wheeler, Chas. A.
Walsh, J. Ellsworth.	*Wheeler, Gilman A.
Wales, Herbert E.	*Wheeler, Herbert L.
Walker, H. M.	Wheeler, Walter F.
Walker, Hugh.	Whipple, Albert E.
Walkley, G. A.	Whipple, John A.
*Wall, Clarence H.	White, Chas. H.
*Walsh, Andrew S.	White, David S.
Walsh, John.	*White, Edwin W.
*Walsh, John E.	White, Edw. Y.
*Walsh, Richard A.	*White, Elmir L.
Walton, John C.	*White, James R.
*Walton, Wm. J.	Whiting, W. H.
*Ward, A. H.	*Whitlock, W. M.
Ward, E. G.	Whitman, E. Francis.
Ward, Sullivan L.	*Whitney, Anville L.

LIST OF DENTISTS — *Concluded.*

Whitney, Horace E.	Wood, Edwin D.
Whitney, Sumner C.	*Wood, Peter H.
Whitney, Waldo F.	Wood, Chas R
Whitten, Daniel F.	*Wood, Edw. B.
*Whittle, C. P.	Wood, L. B.
Whittle, D. A.	Wood, Thos. W., Jr.
Whittle, Thos.	Woodbury, Geo. E.
Whittemore, Geo. F.	Woodbury, Geo. H.
*Whittemore, Geo. H.	Woodbury, Harvey W.
Wiksell, Gustave P.	*Woodcock, A. H.
*Wilbur, Truman R.	*Woodcock, Fred H.
Wilder, Frank I.	Woodfall, Wm. H.
Wilcox, Arthur G.	*Woodman, H. C.
Wiley, J. K.	*Woodward, Marion L
Williams, D. G.	Woodward, Wm. C.
Williams, Geo.	*Wolfe, O. P.
Williams, F. W.	Wolsen, Ludwig.
Williams, Frank H.	*Worthen, J. H.
Williams, Jacob L.	Wright, Chas. S.
*Williams, Percy M.	Wyer, Geo. T.
Williams, Wm. E.	*Wyllie, Nathan P.
*Willard, Sumner P.	Wyman, Adolphus F.
Wilson, Chas.	Wyman, Charles F.
Wilson, C. P.	Yale, Wm. B.
Wilson, Eben M.	*Yale, Geo. Win.
Wilson, John D.	Yale, Joseph.
*Wilson, Lewis W.	Young, Carlos A.
*Wightman, Erle.	*Young, J. Edson.
*Wilkinson, Frank M.	*York, Chas. F., Jr.
Wing, C. Sherman.	Zutchman, Leonhardt E.

* Granted certificates by examination.

PUBLIC DOCUMENT

. . . . No. 39.

ELEVENTH ANNUAL REPORT

OF THE

**MASSACHUSETTS BOARD OF REGISTRATION
IN PHARMACY**

FOR THE YEAR 1896.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
1897.

Commonwealth of Massachusetts.

REPORT.

Boston, Oct. 1, 1896.

To the Honorable ROGER WOLCOTT,

Acting Governor of the Commonwealth.

SIR:—In submitting to your Honor this, the eleventh annual report, from the Board of Registration in Pharmacy, we present briefly such facts and data as will exhibit the work of the Board. If fuller details are desired they will be furnished from the records of the office.

The efforts made by the Board in 1895 to carry out the intent and purpose of the law of 1894, relating to the granting of liquor certificates to druggists, the suggestions and requests in our last report for such changes in the law as would make the intent and purpose more definite and effective, caused much discussion by the press and the Legislature from January to May, 1896. In view of the very general depression of business, the misunderstanding and at times malicious misrepresentation of the efforts of the Board were most unfortunate, and may prove in their results a loss rather than a gain to reputable pharmacy. While there has been progress in the educational and skilful conduct of drug stores as a class, and every city and many towns have what may be considered a strictly reputable and absolutely reliable pharmacy, there are also many so-called drug stores that are unreliable, hazardous, a source of much that is evil, demoralizing, and a menace in any community. Many stores of this class were, and some are now, owned and controlled by ex-saloon keepers and others who employ a registered pharmacist who has an interest on paper only, or at best a nominal investment, thereby largely increasing the number of drug stores beyond any legitimate demand, and in too many cases forcing a resort to illegitimate pharmacy.

The sale of domestic and proprietary medicines, harmless, useless and poisonous, by grocers, dry goods, fancy goods, department and other stores, is also a hindrance, as they are allowed to dispose of their goods, poisonous and otherwise, without the restraint imposed upon a registered pharmacist. These conditions are formidable and serious and prevent the progress of reliable pharmacy and the protection of the public. The dispensing of drugs, medicines, chemicals, pharmaceutical preparations and very many of the so-called domestic remedies, outside of drug stores, simply and heedlessly as they would sell a paper of pins or a roll of tape, may be a convenience, but is of necessity a hazard to the people, a wrong to the educated pharmacist, a fraud upon honorable responsible and protecting lines of public service, and oftentimes a serious injury as well as a loss of time and money to the unsuspecting purchaser, who is led to believe a pill is a pill, a medicine of any kind is the best of its kind and exactly what is required. If it were possible to confine the sale of drugs, medicines, chemicals and poisons entirely to the registered pharmacist, as in some countries and several of the States, prohibiting the peddling from house to house and the indiscriminate vending of the worse than useless nostrums, a great public good would be accomplished, and progress in pharmacy would rapidly assume a higher plane of safety and service. During the past ten years there have been such changes in the art of manufacturing and dispensing, in methods of administration of medicines and in surgical appliances, that the reputable family drug store is required to carry a much larger and more varied stock than ever before. To meet the demands for the many new and constantly increasing developments of science and pharmacy requires closer attention and a much higher grade of pharmaceutical intelligence and skill, that errors may be avoided by the detection and rejection of remedies made worthless by time, exposure or chemical change, involving a larger investment, very much smaller margins and a greatly increased expense account.

During the year closing Oct. 1, 1896, 42 meetings of the Board have been held, for the examination of 575 applicants for certificates of registration in pharmacy, as follows : —

EXAMINATIONS.

						Examined.	Registered.	Refused.
1895.								
Oct.	1-3,	.	.	.	.	36	3	33
Nov.	12-14,	.	.	.	.	44	8	36
1896.								
Jan.	7-9,	.	.	.	.	41	11	30
Jan.	21-23,	.	.	.	.	39	5	34
Feb.	12-14,	.	.	.	.	41	14	27
March	3-5,	.	.	.	.	41	10	31
March	17-19,	.	.	.	.	41	6	35
March	31, April 1, 2,	.	.	.	.	46	10	36
April	14-16,	.	.	.	.	45	8	37
May	5-7,	.	.	.	.	42	8	34
May	26-28,	.	.	.	.	40	5	35
June	9-11,	.	.	.	.	40	7	33
June	23-25,	.	.	.	.	46	13	33
Sept.	8-10,	.	.	.	.	33	2	31
Totals,						575	110	465

During the year, of the 110 who received certificates, —

18 passed on the 1st examination.				
10	"	"	2d	"
28	"	"	3d	"
22	"	"	4th	"
12	"	"	5th	"
6	"	"	6th	"
3	"	"	7th	"
3	"	"	8th	"
1	"	"	9th	"
1	"	"	10th	"
2	"	"	11th	"
2	"	"	13th	"
2	"	"	14th	"

As exhibiting the reason of so few passing the Board, we present the age and rating of 5 applicants. We require 200 out of a possible 300 : —

1. Age, 23 ; oral, 40 ; written, 23 ; drugs, 45 ; total, 108.
2. " 37 ; " 40 ; " 42½ ; " 25 ; " 107½.
3. " 35 ; " 40 ; " 36 ; " 40 ; " 116.
4. " 35 ; " 00 ; " 16½ ; " 15 ; " 31½.
5. " 20 ; " 40 ; " 32 ; " 15 ; " 87.

As compared with the above, we give a rating made at this same examination, —

Oral, 70; written, 78; drugs, 80; total, 228,

plainly showing how many, totally unprepared, would, if permitted, open drug stores.

That pharmacy is still considered by many applicants for registration simply a business of buying and selling drugs, attended by no personal obligation or hazard, requiring little if any study or practical experience, is clearly shown by the following answers, made to simple questions, which are given verbatim: —

“Blue Mass is made with conserve of roses and mild chloride of mercury.”

“Hydrarg. cum Cretae is mild chloride of mercury and chalk,” and not until the applicant was shown the United States Pharmacopœia would he admit his error.

“The official drug obtained from the hog is lard, and is done by heating the abdomen.”

“Cocaine is from the same tree we get Ol. Theobroma from.”

“Lactic acid is from lemons and limes.” Reflecting a moment, said, “I think it is an animal acid; don’t know what animal.”

One applicant, twenty-four years old, claiming four and one-half years of experience, received a rating of $58\frac{1}{2}$ out of a possible 300, calling aromatic spirits of ammonia “hair oil,” and Dover’s powder “pipe clay.”

“Ejusdem means infusion.”

“Camphor gum is obtained by distilling the oil which runs from the camphor tree,” and “opium by distilling poppy heads.”

“Cocaine, cocoa butter and cocoanut oil, all come from the seed of the same plant.”

“Oleic acid is something from the animal kingdom.” Could not explain the difference between analysis and synthesis.

“Jalap is an oleo resin.”

“Forty per cent. of ipecac in Dovers powder.”

“Twenty to thirty per cent. of quinine in cinchona bark.”

“Picra is used in coffee.” “Thirty per cent. of opium in laudanum.”

“To get one grain of opium, give fifteen drops or twenty minims of laudanum.” “Aloes are a gum and can be picked from trees.” This man had been engaged by a saloon keeper to open a drug store if he passed the Board and got a certificate.

“Spermaceti, white wax and parafine come from petrolatum.” Could not tell the source of yellow wax.

“Galls are a fruit like nuts.”

“Forty drops of alcohol in a fluid drachm.”

“Sudorifics sooth the parts applied to.”

“Croton oil is a volatile oil by destructive distillation.”

“Galla is obtained from galls by distillation.”

“One drachm of paregoric contains one grain of opium.”

“Petrolatum is drawn from wells like water, with buckets.”

“Bi means half; proto, six times as much as bi; sub means half.”

“Nut galls are argols, a fruit from plants; both the same thing and from the same tree.”

“Sulphur lotum is made by action of iodine on sulphur.”

“Aloes are from the seed of a plant.” This candidate had not the slightest knowledge of mathematics, it being utterly impossible for him to figure the strength of any preparation.

“Nut galls are a secretion from some animal, don't know what animal.”

One who had been before the Board ten times, and had not obtained a certificate, writes, as the difference between sugar of lead, white lead and litharge: “Sugar of lead comes in crystals and is used in pharmacy; white lead is used more to paint your house and barn with; litharge is a by product obtained in the manufacture of soap and glycerine.”

“Pro in pharmacy means fourth combination.”

“A soporific is anything that will make soap.”

Financial Statement.

Oct. 1, 1895, amount in hands of State Treasurer,	\$230 15
Received during the year from applications,	\$2,081 00
Received during the year from duplicate certificates,	6 00
	<u>2,087 00</u>
Total for the year,	\$2,317 15

Drafts for the year have been made as follows:—

	Services.	Expenses.	
H. M. Whitney,	\$187 50	\$97 91	
F. H. Butler, secretary,	557 50	210 50	
John Larrabee,	205 00	43 81	
A. K. Tilden,	62 50	4 00	
John A. Rice,	195 00	230 36	
	<u>\$1,207 50</u>	<u>\$586 58</u>	\$1,794 08
Vox Populi Press, printing questions,		\$12 75	
Dunton & Potter, printing questions,		8 00	
J. L. Fairbanks & Co., stamped envelopes, etc.,		27 80	
M. P. Bibler, monitor and clerical work,		111 00	
F. H. Butler & Co.,		31 33	
C. F. Hatch, rolls for certificates,		2 00	
Wright & Potter Printing Company, stamped envelopes and printing,		20 52	
		<u>213 40</u>	
Balance,		309 67	
		<u>\$2,317 15</u>	
Cash in hands of State Treasurer,			\$309 67
<i>Liabilities.</i>			
Examinations not made,		\$246 00	
Engrossing certificates (estimated),		10 00	
		<u>256 00</u>	
Leaving a balance of			\$53 67

DEPARTMENT FOR ENFORCING THE PHARMACY LAW.

The administration of this branch of our work during the year has been extremely difficult, requiring thorough and careful investigation, as the complainants in several instances were reputable and law-abiding pharmacists of long experience, having at large expense themselves complied with the law by employing one or more registered assistants, who were forced to compete with new stores conducted with only

one registered pharmacist, and that one absent too long a time and too often. In many complaints of this character it was found the store complained of was opened with the full purpose of doing a liquor business, and the failure to obtain a liquor certificate, or, if obtained, the comparatively small amount of liquor that can be legally sold, induced a general neglect of the business and consequent lack of personal attention also required by law.

By persistent efforts it is hoped this class of drug stores will in time be closed; but the difficulties named on page 13 of our tenth annual report, and which we tried to have corrected by the proposed legislation, still exist, and until corrected will prevent rapid progress.

During the year twenty-two formal complaints have been made by our agent for the action of the Board, thirty-eight complaints in writing have been received and many verbal complaints have been made at the office, most of which were of sufficient importance to investigate. In the summary of the agent's report will be found several cases of interest, to which special attention is called.

In connection with this department of our work (enforcing the pharmacy law) fifteen special meetings have been held by the full Board, and four certificates of registration in pharmacy revoked altogether; two were suspended for six months each, one for nine months, one for twelve months and one placed on file with reprimand.

In one of the above cases of revocation action was delayed for sixty days by special request, as it was claimed the imprisonment of ninety days had been of such corrective influence and service that reformation was absolute and the man could be saved; but the habit of selling and drinking was too strong, and the Board were forced to apply the full penalty of absolute revocation.

We have remaining on file, awaiting developments, the following cases: —

A man and his wife, both registered as required under the law of 1885. At their trial in the police court they both promised their certificates of registration in pharmacy should not be used again, and the cases were placed on file. They refused to give up the certificates.

Two cases that were fined one hundred dollars each in the lower court, but failed of conviction in the superior court.

One case that failed of conviction in the lower court.

One case where the defendant pleaded guilty to the charge, but, owing to a technical point of law, was discharged.

One case where the defendant has left the State.

One case depending upon the conviction of above.

Five cases awaiting action of courts and the Board.

Financial Statement from Oct. 1, 1895, to Oct. 1, 1896.

Services of the Board, including daily attendance and records

of the office,	\$460 00
Expenses of the Board,	124 08
Special duties of the president,	150 00
Miscellaneous,	33 33
Clerical and stenographic services,	164 00
S. B. Harris, agent, services, \$560, expense, \$333.30,	893 30
Total,	<u>\$1,824 66</u>

Vouchers in detail at Auditor's office.

LIQUOR CERTIFICATE DEPARTMENT.

The law requires the Board to issue a certificate by which a registered pharmacist may obtain a sixth-class license, provided the Board can say he is a proper person and the public good will be promoted. In some cases where the liquor certificate has been granted and a license to sell intoxicating liquor secured gross and flagrant violations of the law followed. To secure a conviction in court for such offences is not a part of our work, and we appreciate fully the difficulties under which local officials labor in securing such evidence as will convict. To meet this condition it was proposed last year that the Board should have authority, after an investigation and proper hearing, to revoke the liquor certificate, which would also revoke the sixth-class license, and in this way enforce a rigid observance of the provisions of the license. It was not proposed nor suggested that the revoking of the liquor certificate should affect the certificate of registration as a pharmacist, but it was made to appear that such was the purpose of the Board. It was also represented that re-registration once in two years meant re-examination, when, in fact, it meant simply a *renewal* of certificates; and the advantages of a biennial renewal must be apparent to all who have any interest in the progress of pharmacy.

That the Board was established for the elevation and protection of reputable pharmacy, the protection of the people from incompetent and reckless dispensers, and that such has been the purpose and effort of the Board, are recognized facts.

In response to the popular demand of the people, that some of the most disturbing conditions which have brought discredit to the pharmacist, a detriment to the cause of temperance and morals, should be corrected, power was given the Board to enforce the pharmacy law and to have also a limited control of the liquor selling in drug stores. The Board are in no sense seeking police duties; but if, in addition to the original work placed upon them, the Legislature year by year adds to their duties, and if they are expected to regulate and control the sale of intoxicating liquor in drug stores, is it not wise that the laws should be made more effective? We have reason to believe that in some instances, where we have refused the desired certificate, liquor is sold, sometimes with great care and judgment, sometimes without care and in direct violation of law. This condition exists in some localities where no sixth-class licenses are granted, the officials evidently preferring to take the chances of *no* license rather than refuse one or more of a doubtful character or reputation. In such localities there can always be found those who feel they will be protected by the officials, as they use great care and discretion and are willing to take the chances, others who are not willing to take any chances, and still others who strive to make sales enough to cover the risk. In several no-license places, where these conditions exist, we have had many serious complaints, and it is almost impossible to correct the evil, as we are made to appear as antagonizing the officials if we take any action.

Liquor Certificates to Druggists.

Applications received from Oct. 1, 1895, to Dec. 1, 1895, to expire May 1, 1896,	43
Applications received from Jan. 1, 1896, to Feb. 28, 1896, to expire May 1, 1896,	19
	<hr/>
	62
Granted,	44
Refused,	18

Applications received from March 1, 1896, to Oct. 1, 1896, to expire May 1, 1897,	1,158
Granted,	1,020
Refused,	138
Total number of applications for the year,	1,220
Total number of certificates granted,	1,064
Total number of certificates refused,	156

Since our last report a complete canvass of the city of Boston has been made and every drug store visited by our agent. A similar canvass is now being made by him of all the towns and cities of the Commonwealth.

During the year we refused about one hundred or more applications for certificates to persons who had failed to comply with the law in making legal entry and proper record of sales; but, upon receiving a written promise for the future that all sales should be recorded and a strict conformity to the law maintained, nearly all were granted certificates.

From such data as the Board have been able to gather, the sale of intoxicating liquors in the drug stores of the Commonwealth has during the past year been reduced not less than two-thirds, as an average, and in some localities a greater reduction has been made. The work has been attended with some friction and open hostility, but we know our efforts have met with the hearty approval of reputable pharmacists and the endorsement of the law-abiding people of the State.

Fifty sessions of the Board have been held for the purpose of passing upon applications, and impartial hearings have been given in every case where the justice of a refusal has been questioned. In several cases where the reputation of the drug store has been notoriously bad, and in others where the opening of a new store indicated a probable liquor business, we have required some assurance, either by delay in granting, that a record might be made, or satisfied by facts, that our action in certifying to "proper person and public good" had some data to stand upon.

In one city, if not more, where the officials, it is claimed, do not enforce or even make an attempt to check the violation of law in the sale of liquor by druggists, individuals or

an organized body have employed detectives or spotters from outside the State, and sworn testimony has been given of a most reckless and demoralizing condition.

Earnest appeals are made to the Board for aid and assistance in work of this kind, and the statements of facts are so strongly and forcibly presented that we are compelled to admit the probable validity of the charges; but we have never felt that it was, under the law, our duty to attempt detective or special police work, and certainly we have no such desire. We must admit, however, that there are existing conditions in several cities and towns where, by the abuse of the sixth-class license, the sale of intoxicating liquor is such an injury to the public that any proper means would be justifiable in an effort to stop it. Reputable, law-abiding pharmacists are suffering seriously by the acts and conduct of such stores, and progress in pharmacy under such conditions can hardly be expected. Can relief be given?

Financial Statement from Oct. 1, 1895, to Oct. 1, 1896.

Services of the Board, including daily attendance and records

of the office,	\$1,565 00
Special duties of the president,	600 00
Expenses of the Board,	436 24
Miscellaneous,	182 27
Clerical and stenographic,	480 00
S. B. Harris, agent, services, \$742.50, expenses, \$486.59,	1,229 09
Total,	<u>\$4,492 60</u>

Vouchers in detail at Auditor's office.

Received for liquor certificates,	\$1,262 00
Returned to rejected applicants,	\$198 00
Paid to State Treasurer,	1,064 00
Total,	<u>\$1,262 00</u>

CONCLUSION.

In no way can a clearer and more definite statement or illustration be presented of our work and its results than will be found by a review of our several annual reports.

The examination department, for which the Board was originally established, has never been an expense to the State, but has been conducted by personal sacrifice of each

member, his bills being made, not for full time of services rendered, but to come within the fees received after paying all other expenses, such as printing, postage, etc. The secretary of the Board, in the performance of his duties, is obliged to give many days' service in correspondence, records and preparation for this department, in addition to the days of examination.

The enforcement of the pharmacy law, the granting of liquor certificates and the administration of the poison law have been placed under the special supervision of the Board. To keep an accurate rating of about two thousand drug stores, to investigate all complaints, prepare and arrange all the applications for the liquor certificates (which, on account of changes, come in every week during the year), the general charge of all duties excepting the examinations, require daily attendance at the office, and have been made the duty of the president of the Board.

It is again suggested that the several departments of our work, the granting of certificates for registration in pharmacy, enforcing the pharmacy and poison laws and the granting of liquor certificates, be merged in one account, and an annual appropriation be made, covering all.

If these varied duties are to continue, the work should be well done, and with the appropriations as now made it is an impossibility. More prompt and rigid investigation should be made, by the permanent employment of an agent whose whole time should be given to the work. The members of the Board should receive such just compensation as the duties and responsibilities demand, and devote as much time in an exhaustive investigation as may be required.

Respectfully submitted,

H. M. WHITNEY.
F. H. BUTLER.
A. K. TILDEN.
JOHN LARRABEE.
JOHN A. RICE.

AGENT'S REPORT.

Boston, Oct. 1, 1896.

To the Board of Registration in Pharmacy.

GENTLEMEN:—In presenting to you my annual report, it seems that a lengthy account of the work performed under your orders is unnecessary, as monthly reports have been made to you, giving all the important details during the past year.

The work performed under instructions of the Board has taken me to every portion of the Commonwealth and to some cities and towns several times, so that I have had an opportunity to observe whether our labor has been in vain or some good has resulted, and I am happy to state that a marked improvement has been made in the right direction. During this year not so many complaints have been made of criminal violation of the pharmacy law as were made during the year 1895, nor as many complaints to the Board during the year just closed as were made the year previous. A comparison of the statistics of 1895 with the statistics of 1896 bears out this statement; and, as the impostor and bogus druggist are driven out of the pharmacy business, so will the profession take a higher standing in the community. In several instances violations of the pharmacy law have been corrected by simply calling them to the attention of the druggist, who rectified them at once. This has always been more desirable than to resort to prosecutions, which have only followed in cases of flagrant violations, where forbearance had ceased to be a virtue. One thing has become apparent,—the back room is no longer a loafing place for those who have not quite the courage to stand up to a bar and “take it straight.” Another noticeable feature is that the quantity of spirituous liquor bought at wholesale has greatly dimin-

ished, and the legitimate pharmacist sees respectability returning. But there is work to be performed on the part of the druggists of Massachusetts in order that the ideal standard may be obtained; and by their co-operation with the Board of Pharmacy, assisted by the local authorities, their expectations will be realized.

I might state the work accomplished, giving particulars of various prosecutions, time taken up in attending court, etc.; but the details have all been laid before you, the results are set forth in the recapitulation, and results are of more interest to the public and ourselves than much writing or speaking.

Many stories might be told of the various ways and means taken to evade the law by those who have no conception of legitimate pharmacy, — of grocers, stable keepers, saloon keepers, milkmen and others who heretofore embarked in the drug business without any pharmaceutical qualifications whatever. But the charms for them are gradually disappearing, and drug stores operated in Massachusetts without being under the supervision of registered pharmacists have become a thing of the past.

In order to give the public and pharmacists an idea of the qualifications of some pretended druggists, who only serve to degrade the profession, having opened so-called drug stores prior to the enactment of the law of 1893, which made it a criminal offence to expose drugs, medicines, chemicals and poisons without being under the supervision of a registered pharmacist, and who by various devices have tried to maintain the same without conforming to the law, until by repeated prosecution they were forced to abandon the business, the following may be interesting.

In the city of —, a man by the name of — first made his appearance in the police court charged with having in his possession milk not up to the standard. He was a milkman. Presently he opened a drug store and commenced business. Complaints came to the police department and to the Board of Pharmacy, setting forth that this store was a rum shop; prosecutions followed; charges of violating the liquor law were preferred. Upon inspecting the premises, the agent found displayed a certificate of registration belonging to a registered pharmacist who owned and supervised a drug store

located in another town. A criminal complaint was made against Mr. —, charging him with unlawfully keeping and exposing for sale drugs, medicines, etc., and he was arrested. In the mean time a formal complaint was made to the Board of Pharmacy against the owner of the certificate of registration. He was summoned before the Board and dealt with accordingly; but the former milkman kept his store open without any registered person connected therewith, and claimed the right to do so by displaying a placard, printed in large type, “*No drugs or medicine sold here.*” However, this attempt at evasion of the law did not protect the offender. The officers of the law still had an eye on his place. Another prosecution followed, and a short time ago the milkman gave up the pharmacy business, which had become very uncongenial, and embarked in horse trading.

Perhaps it would not be amiss to narrate the experiences of one or two so-called druggists, giving a report of the manner in which they have conducted their business, together with their records and the sudden termination of their careers. Names and places are omitted, but all statements made may be verified by the records at the office of the Board of Registration in Pharmacy.

In January, 1896, a variety show was billed to give performances in the town of — for one week. Upon the opening night the manager, in company with one of the *attachés*, started for the hall. On the way the manager stepped into the drug store of Mr. — to leave some hand bills. As the manager was leaving the store the druggist said, “Won’t you have something to take?” The reply was, “I am not drinking now.” But the druggist said, “I have something here that won’t hurt you; have some.” Thereupon a hot drink was prepared for the manager, who drank the beverage. When the curtain arose the manager had not arrived. He, however, appeared later upon the scene of action, but his condition was such that a quarrel ensued, the outcome of which was sufficient to disband the organization. The manager drifted back to the drug store and disappeared from view until about eleven o’clock the following forenoon. After appearing for a short time at the hotel where the troupe had engaged rooms, he vanished again within the alluring precincts of the drug store, and

nothing was heard of him until about midnight, when a boy messenger from the store called upon the landlady of the hotel, informing her that "The man who belongs to that troupe is unconscious in the back room of our drug store, and we cannot arouse him." The landlady put on her outside garments and hastened to Mr. —, who is clerk of the district court, and informed him in regard to the matter. The clerk immediately hunted up the police officers, giving them the information, and they repaired at once to the drug store in question. Upon meeting the druggist the inquiry was made, "Is Mr. — here in your store?" "No," was the reply; "I requested Mr. — and Mr. — to take him to the hotel, and they have done so." Upon the officers inquiring at the hotel, they learned that the manager had not appeared. The officers thereupon interviewed the two men referred to, who replied, "We know nothing about the affair," and accompanied the officers in their search for the man in question. While the officers were on this wild-goose chase, the manager was removed from the back room and laid upon a snow bank upon the side hill at the rear of the store, the man who assisted telling his wife, on reaching home, what they had done. His wife, who immediately realized the situation, replied to her husband, "Why, that man will be frozen to death before morning. If you don't report this case to the police officers, I will." Thereupon her husband told the facts to the officers, who, on arriving at the place where the manager had been left, found that he had disappeared, but traces in the snow plainly indicated that he had been dragged to a building in process of construction, with no doors or windows, and deposited upon the floor, where he was found unconscious, with life nearly extinct. He was taken to the hotel, a physician was summoned, and it took the remainder of the night to restore him to consciousness, and two weeks elapsed before he was able to leave town.

This case was thoroughly investigated, and a formal complaint was made to the Board by their agent, together with the record of the druggist in question, which is as follows: His first appearance in court was on Nov. 9, 1886, charged with the illegal keeping and exposing for sale of intoxicating liquors. He pleaded guilty, and paid a fine of fifty dollars.

On Nov. 15, 1895, he appeared before the court charged with assault and battery, pleaded guilty, and paid a fine of forty dollars. On Nov. 22, 1895, he appeared before the court charged with keeping and maintaining a common liquor nuisance, pleaded guilty, and paid a fine of one hundred dollars. On Feb. 25, 1896, he appeared before the court charged a second time with keeping and maintaining a common liquor nuisance, and received a sentence of four months' imprisonment and a fine of one hundred and twenty-five dollars. After his discharge from prison, on June 26, 1896, he was summoned to appear before the Board of Registration in Pharmacy, to show cause why his certificate of registration in pharmacy should not be suspended or revoked altogether; and after hearing all the facts, the Board revoked the same altogether, thereby relieving the community of another drug store in name but in reality a rum shop in disguise.

Another so-called druggist, by the name of —, lived in the city of —. He was formerly a man of good address and appearance and had many friends, but of late years he had become a victim of intemperance, and for days at a time was intoxicated at his place of business. Next he took to gambling, and finally his drug store became a liquor nuisance. Complaints came to the Board, as you well know, setting forth that this man was intoxicated at his store, and the question was asked, "Cannot the Board revoke his certificate of registration? He is incapable of dealing in poisonous medicines in his present condition." But the Board had to reply to the complainants, "There is no law whereby the Board of Pharmacy can suspend or revoke a certificate of registration in pharmacy for drunkenness." And so the matter went on. One day the deputy chief of police of this city, in company with your agent, visited this store, only to find the druggist in question intoxicated to such an extent that he assaulted the officer, and it became necessary to arrest him. After his release from custody the place was raided several times, conviction followed, and finally he was convicted in the superior court and sentenced to three months in the county jail and a fine of one hundred dollars. Formal complaint was made to the Board, as the records show; and on May 11, 1896, his sentence having expired, he was summoned to appear before the Board of Registration in Pharmacy, to

show cause why his certificate of registration in pharmacy should not be suspended or revoked. He appeared before the Board, represented by able counsel, and pleaded guilty to the several charges; but the counsel asked a continuance of the case for sixty days, to see if the defendant would not be able to conquer his cravings for strong drink. He could not, however, resist the temptation, and returned to his habits of intemperance. Therefore, at the expiration of the sixty days, the Board revoked his certificate altogether.

Recapitulation.

Number of visits to cities and towns,	327
Number of drug stores inspected,	1,733
Number of criminal complaints made to local authorities,	33
Number of druggists prosecuted and convicted,	29
Amount of fines imposed,	\$2,850
Number committed to prison,	8
Number of months served,	28
Number of complaints made to the Board and investigated,	170
Number of formal complaints made to the Board,	22
Number of drug stores closed,	60
Number of drug stores found doing business without any registered person connected with the same,	12

During the year just closed, visits have been made to nearly every drug store in the State, and with few exceptions I have had the pleasure of meeting the proprietors, thereby becoming better acquainted with them; and for their assistance and courteous treatment I herewith extend my gratitude.

To the officers of the law who have assisted the Board in the enforcement of the pharmacy laws, with many of whom I am personally acquainted, I desire to extend my thanks and kind appreciation of their services.

In conclusion, I wish to testify to the honest efforts put forth by the Board of Pharmacy to correct the abuses, and the endeavors made by them to elevate the business of pharmacy throughout the Commonwealth.

Respectfully submitted,

SIMON B. HARRIS.

PUBLIC DOCUMENT No. 50.

Commonwealth of Massachusetts.

REPORT OF THE COMMISSIONERS

ON THE

TOPOGRAPHICAL SURVEY.

FOR THE YEAR 1896.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
1897.

REPORT.

BOSTON, Dec. 31, 1896.

To His Excellency ROGER WOLCOTT, *Governor of Massachusetts.*

The Commissioners on the Topographical Survey and Map and the determination of the boundary lines of the cities and towns of the Commonwealth hereby present their report of the work executed under their direction during the year 1896.

As stated in their last report, the method, particularly of the field work, has been to commence and carry the work forward, in as regular progress as practicable, from the bases afforded by the triangulation of the United States Coast and Geodetic Survey, bordering on the sea-coast and proceeding westwardly into and through the interior sections of the State.

This plan had been substantially followed up to and including the field season of 1895, and the boundary surveys of the cities and towns in the eastern part of the State completed to about the easterly boundary of Worcester County.

The Commissioners also called attention, in explanation of the general project of their work, to the necessity for what may be termed a special

primary triangulation, in advance of, and as a basis for, the more detailed determination of the points in the city and town boundary lines.

The necessity for such a primary triangulation, felt at the close of the season of 1894, became more evident after what had been done in this direction during the operations of 1895, which were only partially given to this purpose.

After a careful study of the subject and a thorough examination of the ground practicable to be gone over within the limits of a season of field work, the Commissioners determined to equip a party especially for primary triangulation, in charge of Mr. James B. Tolley, to continue the work he had begun in 1895, and, if practicable, connect it with the already established bases and primary points of the Coast and Geodetic Survey in the Connecticut River valley and its vicinity.

This work has been accomplished by Mr. Tolley during the past season of 1896, and a primary triangulation carried over the central part of the State, as above referred to, starting from the base lines "Blue Hill" — "Prospect Waltham" in Massachusetts and "Blue Hill" — "Beaconpole," the latter point being in Rhode Island, and closing on the more westerly points of "Wachusett," "Mt. Tom" and "Greylock" in Massachusetts, "Monadnock" in New Hampshire and "Bald Hill" in

Connecticut. It may give an idea of the magnitude of this work to state that the length of one of these primary lines, observed, was over fifty miles, and the area of one of the triangles over seven hundred square miles. The particulars of the work executed during the present season of 1896 will be given further on in this report.

The Commission have carefully considered the question of publishing the results of their town boundary determinations. The work of these surveys has been a complicated and difficult one, affected largely by the character of the country and the often inaccessible position of the town boundary points. In conducting the survey the Commissioners and their working corps have found much to learn in effecting the most practicable and economical methods of executing it. It has been a tentative process, with no precedents in similar work to guide their operations. The question, however, of absolute accuracy, within advantageous limits, has been the constant aim and purpose of the survey.

The most desirable manner in which to present the results of the town boundary surveys has seemed to the Commissioners to be in the form of a portfolio for each city and town, which shall contain a map or plan of each municipality, accurately drawn to a given scale, showing

the outlines of its boundary and the geographical position of each "corner" and "angle" therein, as defined by law, and the true bearing and distance from each to each; also, in like manner, the geographical position of the points of independent triangulation which have been the bases from which the town boundary points have been determined. The portfolio will also contain a plan or sketch of each town boundary and each triangulation point, as above defined, showing its location, and such surrounding features as will serve as witness marks to preserve and identify the exact position of each point. A statement in tabular form will also be given of the latitude and longitude of each boundary point and the azimuth, (true bearing), in terms of angles, and the distance in metres and feet from point to point throughout the outlines of the boundary. The geographical position, azimuth and distance from each to each of the points of triangulation, as above defined, will be given in like manner.

A description will also be given of the *markings* of these points of triangulation, including such underground and other witness marks as may have been established. The preservation of these points has been regarded of so much value and importance that the Legislature passed the following act, at the recommendation of the Commission: —

[CHAPTER 336, ACTS OF 1888.]

An Act to provide for the definition and preservation of town boundary lines.

Be it enacted, etc., as follows :

SECT. 3. The triangulation points established by said commissioners shall be regarded as a part of the evidence of the location of town boundary lines, and a description of the position and marks of such points shall be communicated by said commissioners to the selectmen of the towns within which such points are located, and said descriptions shall be filed with the perambulation records of such towns.

SECT. 4. It shall be unlawful for any persons, except as herein provided, to remove, obliterate or cover up any monument or mark made to designate a boundary line made in pursuance with this act. If in the course of the legitimate occupation of land a person shall desire to obliterate, remove or cover up such monument or mark, any party in interest may apply to the county commissioners of the county in which said monument is wholly or in part situated, setting forth the facts, and asking permission to remove, obliterate or cover up such mark or monument. The said commissioners shall, if they deem the request reasonable, grant the same, after they have made provision for preserving the exact location of the original

boundary or mark in the manner hereinafter provided. When permission is given by the county commissioners aforesaid to remove, obliterate or cover up a monument or mark, they shall, prior to such removal, cause proper witness marks to be set up, or other means taken which shall with proper designation and measurement, indicate the position of the original mark or monument. Said county commissioners shall cause to be recorded, in the office of the town clerk of the contiguous towns, a full description and designation of the witness marks and monuments so made and set up, and shall cause a copy of such description to be forwarded to the secretary of the Commonwealth.

SECT. 5. Any person who shall violate the provisions of the preceding section, or shall wantonly disturb or injure the monuments or marks aforesaid, shall be punished by imprisonment in the jail not exceeding six months, or by a fine not exceeding fifty dollars. [*Approved May 15, 1888.*]

In preparing the portfolios of the town boundary matter for presentation and publication, it became necessary to go over the ground of the field and office work, much of which was among the earlier operations of the survey. It was found that changes had been made in town boun-

daries, by the formation of new townships and the modification of older boundary lines. While it would be quite impracticable and entirely inexpedient to make anything like a re-survey of the whole field of former work, the Commissioners deemed it advisable to bring all the town boundary data, as it was verified and finally completed, up to the time, at least within the year of official presentation, the present issue being that of 1896. This duty has in the main been assigned to Mr. Eugene E. Peirce, and a party equipped under his charge for such field work as was found necessary. Systematic conferences personally and by letter have been held with the municipal officers of the cities and towns which have come within the scope of the present investigation. Mr. Peirce has also made a thorough examination and review of all office data relating to his portion of the work.

Still further in the line of investigation certain field work was assigned to Mr. F. E. Bowman, mainly with a view of determining some of the facts in regard to the definition and preservation of some of the triangulation and town boundary points. Mr. Bowman was instructed to make good any loss or disturbance of their markings, and to note any change of condition or surrounding features affecting their future identification.

The particulars of Mr. Bowman's work will be given further on in this report.

The duties of Mr. James B. Tolley during the first months of the year 1896 were mainly confined to office work, comprising the completion of the sketches of triangulation stations occupied in 1895, and duplicating certain parts of them for the United States Coast Survey, in return for similar data furnished by that Bureau for the use of the Commission; also in computing his own boundary work of 1895 in the vicinity of the Metropolitan water board survey. During the days of March 25 and 26 he took the field to determine the new "boundary corner" of Stoneham, Woburn and Winchester. During part of the month of April Mr. Tolley was engaged in reviewing and computing some former surveys in Dukes County, which proved to require additional field work. This was accomplished and satisfactorily adjusted.

In explanation of the general work of the field season, we quote from Mr. Tolley's report to the Commission, as follows: —

HENRY L. WHITING, *Chairman Topographical Survey Commission.*

DEAR SIR: — At a meeting of the Commission, held on April 1, I was detailed to make a primary triangulation to cover that part of the State lying between the former surveys along the Atlantic

sea-board and the valley of the Connecticut River. On the 5th of May I organized a working party, and took the field for the execution of this work. It was necessary to recover, first, the primary triangulation stations of the United States Coast Survey falling within the scheme of my intended survey, some of which had not been occupied for years. As the State triangulation had to be based upon these stations of the government survey, it was important that a careful examination and verification of the exact position of each station should be made before erecting signals over them for use in my own survey. In some cases the hill tops upon which these older stations were located had become overgrown with heavy timber, through which sight lines to the connecting stations had to be cut; in one instance the timber cut down amounted to over fifty cords. Bald Hill, Beaconpole, Peaked Mountain, Mt. Grace and Provens Mountain were the stations covered with timber where more or less cutting had to be done.

After these primary stations were identified and signals built over them, a few new locations—hill tops—were selected for stations of secondary triangulation, to connect with the still more detailed work of the town boundary survey, thereby making a series of quadrilaterals in the scheme of secondary triangulation.

After all the needed signals were erected and the stations made intervisible, I commenced the operations of my actual survey by occupying "Prospect Waltham," from which station I posted heliotropes at "Beaconpole" and at Wachusett Mountain. I also experimented successfully with what I call a stationary heliotrope with fixed reflectors operated in the usual way, but which could be left upon the hill top without injury from the weather. This proved a labor-saving apparatus in the work of my survey.

After completing my observations at "Prospect Waltham" I moved my party to Hyde Park, and on June 12 commenced work at "Blue Hill" station, observing upon all the intervisible stations excepting that of "Marlboro," where no signal was up. I was therefore obliged to send a man with a heliotrope to that station, which somewhat delayed the completion of my work at Blue Hill. I then moved my party to Arnold's Mills in Rhode Island, and on June 17 commenced my observations from "Beaconpole." My work at this station was much interrupted and retarded by bad weather, but after completing it I moved my party to Union, Connecticut, and on July 6 occupied and commenced observations at Bald Hill.

After finishing my work at Bald Hill I moved my party to Paxton, Mass., and on July 16 occu-

pied and commenced observations at "Bumskit" station. After finishing my work at "Bumskit" I moved my party on July 29 to Wachusett Mountain. At this station I was considerably delayed by bad weather, losing in all ten days on this account. The hotel building on Wachusett Mountain cut off the line of sight to the stations at "Monadnock" and "Mt. Grace." To overcome this difficulty I had to establish an eccentric station No. 1 for "Monadnock" and No. 2 for "Mt. Grace," marking each eccentric point for future determination. On August 24 I moved my party from Wachusett to Monadnock in New Hampshire. In connection with my work at Monadnock I will mention briefly the method I adopted to get the angle between Wachusett 1 and my other stations. I posted a heliotrope at this point, — Wachusett eccentric No. 1, — and measured the angles between it and my other stations with as much care as the other direct angles, and by simple computation converted the angle to centre, and obtaining the result of the true angle between Wachusett *centre* and another station. I will further say, that by my preliminary computations I found the triangles containing the eccentric angles at Wachusett filled as closely as those with no eccentric angles in them. On September 1 I moved my party from Monadnock to

“Mt. Grace” in Massachusetts. At this station I pointed on Wachusett 2 eccentric and converted the angle to centre in the same manner as at Monadnock.

On September 9 I moved my party to the town of New Salem, to occupy the station on Packard Mountain. This station properly belongs to the secondary class of our triangulation, but it is an important point in that scheme, and, as it was located in the line of my travel from Mt. Grace, I thought it good economy to stop and occupy it, which I did with good results. On September 21 I left New Salem for Easthampton, from which place I occupied “Mt. Tom.” During my stay at this station my work was much interrupted by bad weather, which continued through nearly the whole of October. While at this station two of the most efficient members of my party left it to enter the Institute of Technology at Boston, which still further embarrassed me in the progress of my work. On October 16 I moved from Easthampton to Amherst, to occupy the station at “Hilliard’s Knob.” This station was the last in my contemplated present scheme of primary work. There still remained, however, another point on “Peaked Mountain” in the system of secondary triangulation, which it was desirable and advantageous to occupy while so near at hand; and I

therefore moved my party from Amherst to Monson, and occupied this station, "Peaked Mountain," closing my season's work and disbanding my party on November 9, and reporting in person at the office of the Commission in Boston on November 10.

Of the above-mentioned stations occupied during my season of work, six were fixed points of the United States Coast Survey, and providing us with five additional *primary base lines*, viz.: *Blue Hill to Prospect Waltham; Blue Hill to Beaconpole; Prospect Waltham to Beaconpole; Bald Hill to Mt. Tom; and Mt. Tom to Monadnock.* Two of the new points, viz., Wachusett 2 and Bumskit, are common to these eastern and western base lines, not only making the new points measurably strong, but giving the opportunity to compare the value of the State work with that of the primary triangulation of the United States Coast Survey.

In measuring the angles throughout the season's observations I used the 5 second, 3 vernier, 8 inch repeating theodolite No. 152, belonging to the United States Coast Survey, and loaned to the State Commission through the official relations of its chairman, Mr. Whiting, as a member also of the government coast survey. This theodolite has a powerful telescope, and fitting on the top

of the instrument is an azimuth compass, which I used for getting the bearings of the witness marks to the stations occupied and to determine the variation of the needle at the trigonometrical stations. Five heliotropes belonging to the Coast Survey were used in connection with my observations; two of them, recently received from its office, were brass instruments of first-class construction, each with a powerful telescope and a graduated limb for directing the reflection to the connecting station. The other heliotropes were of a cheaper grade, made of iron and fitted with a less powerful telescope. All of these instruments were used constantly during my summer work. I would again refer to the stationary heliotropes, in order to describe their construction. They were made of two pieces of galvanized sheet iron, each nine by twelve inches in size, with hinges riveted upon the bottom for fastening upon a board. In each piece of sheet iron holes were made, four and five inches respectively in diameter, and on either side of the holes grooved strips of iron were fastened for guiding a tin slide, laterally upon one and vertically upon the other. This tin slide is five by eight inches in size, with an aperture two and three inches respectively. Across each aperture, and intersecting at the centre of it, are cross-

hairs. When the two pieces of sheet iron are standing upright upon a board or table, about thirty inches apart and pointed nearly at the distant station and then fastened securely in place, it can be readily seen that, with the two (front and back) apertures movable, one laterally and the other vertically, there is no difficulty in accurately pointing at any desired object, with little or no trouble. The reflector—a good looking-glass—is then placed back of the two upright sheets of iron, and the sun's rays cast through the two apertures, the nearer one being the larger. I would here mention the fact that throughout the season's operations the persons using them preferred these "stationary heliotropes" to the other more elaborately made ones of the usual style. Extreme care was used in all my work to centre accurately both the theodolite and heliotrope over the respective station points.

The theodolite, when used, was always under an observing tent, which was placed under and securely fastened to the large tripod signals which were uniformly built at the respective stations. This shelter enabled me to observe in windy weather. The usual system of measuring angles was adhered to, viz.: twenty-four pointings making a set, twelve forward and twelve back; six sets were measured to complete an angle in the

primary work, always beginning at zero with the first set; the beginnings of the remaining sets — if of the primary — were, in every succession, 60° of the limb, the last set beginning at 300° . For secondary work, I began on every succession at 90° of the limb, the last set beginning at 270° . My average variation per set was less than three seconds.

With a few exceptional days, the best results were obtained in the afternoons; the heliotrope's light would then appear smaller, and consequently a more clear and perfect contact was possible with the cross-hairs upon the signal observed at each pointing.

My party consisted of four persons besides myself, three of these heliotroping at distant stations, while one was with me at my observing station.

Through the earlier and longer part of my field work the members of my party were: Harold B. Mayhew, Clinton D. Thurber, G. William Rogers and Walter W. Baker, succeeded toward the end of the season, excepting in the case of Mr. Mayhew, by D. Russell Perry, H. A. Phelps and F. P. Kiss. All of them were efficient, faithful and industrious, giving their best efforts to the work assigned to them. Harold B. Mayhew and H. A. Phelps made the topographical sketches of the triangulation stations, using a one hundred foot tape and the transit No. 1192 belonging to the

commission, each doing very excellent work in that line. All of the triangulation stations occupied this season were located upon rocks, and to mark each station a triangle was cut in the rock around each centre point and drill holes enclosed in squares were also cut in the rock as witness marks, and the azimuth and distance from the central point accurately measured, and a sketch and record made of all the markings for future identification.

The following is a summary of the season's work: —

Number of signals built,	13
Number of triangulation stations occupied,	12
Number of triangulation stations determined,	11
Number of triangulation stations sketched,	11
Number of angles measured,	7,719
Area of State covered (square miles),	3,000
Area of largest triangle (square miles),	766
Longest line observed (miles),	51

After closing his field work, Mr. Tolley, as before stated, reported at the office of the commission in Boston for further duty. This work has consisted in a general review and classification of his field work, sketches, note books, etc., in readiness for final computation and completion. It was the wish of the commission that Mr. Tolley should take these records and data to Washington, for the purpose of availing himself in the interest

of the State work of the resources of the office of the Coast and Geodetic Survey, and to ensure accord in the co-operation with the surveys of the United States in connection with the primary triangulation of Massachusetts. A letter of request in regard to this project was written by the chairman to the superintendent of the Coast Survey, to which the following courteous and favorable reply has been received: —

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., Jan. 4, 1897.

MR. HENRY L. WHITING, *Chairman Board of Topographical Survey*
Commission, Commonwealth Building, 11 Mount Vernon Street,
Boston, Mass.

SIR: — Referring to your letter of December 31, I have to say that we shall be glad to allow Mr. James B. Tolley, a member of the Field Corps of the Topographical Survey of the State of Massachusetts, to bring his results to this office for the purpose of availing himself of our data, and to obtain such assistance from the computing division as may be necessary.

It is understood that any expense that may be incurred in copying data or computations will be paid by the State Commission of Massachusetts.

Yours respectfully,

(Signed) W. W. DUFFIELD,

Superintendent.

The duties of Mr. Eugene E. Peirce, referred to in the earlier part of our report, have been mainly those of inspection and correction of the surveys which are included in the series of town boundary portfolios under preparation for publication. In his field operations Mr. Peirce has verified and determined and re-determined 151 town boundary points, and has run by traverse 17.18 miles of boundaries which were laid out highways. This field work has completed the record of boundaries of all the towns in Barnstable County, 15 in number; cities and towns in Plymouth County, excepting only the boundaries of Hingham, Hull, Marshfield, Norwell, Pembroke and Scituate, which were omitted on account of certain proposed and incompleated changes in some of the boundaries relating to these towns. The following townships in Bristol County have also been inspected and revised: Acushnet, Berkley, Dartmouth, Fairhaven, New Bedford, Freetown and Fall River. Mr. Peirce cites an instance of agreement in the position of a town boundary point in Dartmouth as determined by the two systems used in surveys, namely, by direct trigonometrical observation upon the point itself, or by a traverse from a fixed triangulation station to a given town boundary point. In the case in question Mr. Peirce reports: —

Mr. HENRY L. WHITING, *Chairman*.

DEAR SIR:—In my system of triangulation for the determination of the Dartmouth and Westport line there were two stations (Cellar and Winnifred) determined by triangulation. A traverse line was run from the station Cellar to the station Winnifred, a distance of about 1.5 miles, to tie in the corners between the two stations. The following result shows the position of Winnifred as determined from the two computations:—

	Latitude.	Longitude.
By triangulation,	41° 37' 49".16	—71° 02' 28".40
By traverse line,	41° 37' 49".16	—71° 02' 28".42

an exact agreement in latitude; a disagreement of 1.5 feet only in longitude.

Mr. Peirce was ably assisted in his field work by Mr. A. D. Butterfield, professor of engineering in the Worcester Polytechnic Institute, who made part of the triangulation and did most of the traverse work between July 15 and August 29 inclusive. The other members of Mr. Peirce's party were Mr. E. G. Hunt during portions of May, June, July, August and September, and Mr. F. E. Tibbetts during the entire season. All of these gentlemen have been members of the field parties in former years, and their experience

was of value in prosecuting the present triangulation, each taking a personal interest in the result, and being always ready to do the work assigned to him in a careful and accurate manner.

In connection with the field examinations, the commissioners would again refer to the inadequate and incomplete records and data appertaining to the boundaries of townships as existing in the archives of many towns in the Commonwealth. In relation to this matter, Mr. Peirce in the experience of his summer's work makes the following statement:—

“As the town boundary survey progresses, the imperfect condition of the perambulation returns, and the fact of the disregard by many of the selectmen of the law in regard to marking and erecting bound marks and monuments becomes more apparent, it seems fitting that I should bring the matter to the attention of the commission. I have taken occasion, in former reports, to refer to this subject; and my work of the past two seasons has impressed the facts more forcibly upon me, as it has seriously retarded the progress of the field work.

“During the season of 1895, of 151 boundary points determined it became necessary to have 81 bounds at ‘corners’ which were improperly

marked or not marked at all, put up under the supervision of my own party. My work of the present season, 1896, has also been retarded by lack of proper markings of 'angles' in many town boundary lines. Although understanding that it is not the function of the commission to regard or determine 'road stones', so designated, as decided by the Attorney-General, the field parties have the opportunity in the course of other work to note these points. From my personal knowledge of the facts in regard to them I have made the following estimate: In eastern Massachusetts probably twenty-five per centum of 'road stones' are unset, and in the more westerly sections of the State probably seventy-five per centum are still unset.

“Another difficulty existing in regard to the identification of 'angles' in town lines, is the fact that the returns of the perambulation of these lines cannot be relied upon as authority in determining the existence or position of these points, in so much as the records in regard to them differ from year to year. Another cause of error and uncertainty is the fact that many 'road stones' have been incorporated into the records as 'angles.'”

The commissioners desire to say, in regard to this matter, that the letters of the Attorney-General, since they were issued to selectmen, have had

the effect to correct these omissions and errors of town boundary marking; but the difficulties and uncertainties attending the earlier surveys have necessitated the review and inspection of former work, before referred to in our report.

The office work executed by Mr. Peirce during the year has been the examination of the data and records of the entire operations of the years occupied in the surveys in the easterly part of the State, especially those of Barnstable, Plymouth and Bristol counties, but also in other of the eastern counties. The number of cities and towns so far examined and verified by Mr. Peirce is 43. In addition to these are the 6 townships inspected and verified by Mr. Tolley, making a total of 49.

As a result of this investigation, the commissioners have been able to prepare a series of town boundary portfolios for presentation and distribution.

The work executed by Mr. F. E. Bowman during the year has been that of field and office duty, with a view, mainly, to preparing the results of the surveys for publication. We give the following extracts from Mr. Bowman's several reports to the commission:—

MR. HENRY L. WHITING, *Chairman*.

DEAR SIR:—In accordance with my instructions to make topographical plans and descrip-

tions, and take pictures by photograph of the triangulation stations and town boundary points on Cape Cod, I began operations at Provincetown, and proceeded in each town successively to the line between Barnstable and Plymouth counties. The number of important triangulation stations examined in the ground gone over was 38, which were variously marked as follows: with granite monuments, 1; freestone, 8; marble, 5; copper bolts in rock, 3; iron bolts in rock, 2; drill holes in rock, 2; terra-cotta pipes, 2; located on permanent buildings, 15. The number of town boundary points, "corners and angles," was 94. Of these, 19 are of the required height and over, and 75 less than the law requires. Two of these bounds were covered with sand, but found after difficult search. The sketches, photographs and descriptions of these points show the details of their situation.

On July 24 I completed my work on Cape Cod and returned to the office in Boston, where I remained on draughting and other duties until October 7, when I again took the field, locating at Fall River, to execute work similar to that done on Cape Cod; again returning to the office in Boston on October 24, and resuming my duties there. The number of points visited and described in my field work in the 15 townships on Cape Cod (Barnstable County) was 132.

In addition to the work stated above, Mr. Bowman submits the following record of work done, in the winter months of the year, before taking the field: "Plotted and inked 29 topographical sketches, wrote in ink 29 descriptions, made 4 plans for engineers, made 1 triangulation plan for office, made 14 sketches in the field, revised all data used and all work finished in the drawing department during the above-mentioned time; also made a list of data needed in the preparation of my field work in Barnstable County."

Mr. Bowman has rendered efficient service in all of his office duty, which has been varied and responsible.

Mr. William C. Hawley has continued in a thorough and satisfactory manner his office work of the revision, adjustment and computation of the results of the field surveys and observations, and other matter bearing upon the final completion of the work. We quote quite fully from Mr. Hawley's reports to the commission, as showing the details of some of the office work:—

To the Chairman of the Commission.

SIR:—I have made such a variety of computations that it is almost impossible to give an accurate account of them. I submit, however, the following summary report of my work in the office during the present year, 1896.

The areas of the following towns have been computed: Rockland, Norton, Attleborough, Whitman, North Attleborough, Easton, Rehoboth, Georgetown, Mansfield, Burlington, Lexington, Winchester and Blackstone, also the approximate areas of Peabody, Bradford and Haverhill, involving the computation of 184 latitudes and 184 departures. A B C tables to assist in computing have been made out, and 90 field books revised conjointly with Mrs. Peirce. Ninety-three tables have been made out, showing the geographical positions of 632 town corners, with the azimuth, distance and true bearing from corner to corner. Each table has been computed conjointly with Mrs. Peirce. The several cities and towns are located in the following counties: 15 in Barnstable, 6 in Dukes, 17 in Bristol, 6 in Plymouth, 3 in Suffolk, 26 in Essex and 20 in Middlesex.

Duplicate computations have also been made, conjointly with Mrs. Peirce, determining the true position of the several points marking and defining the "Old Colony Line," so called, showing its deviation from the straight line it was supposed to follow. The results involved the computation of 26 offsets and 24 inverses. The position of the 38 "corners" of Sterling has been computed, involving 4 L.M.Zs. and 38 inverses. The revision and verification of 31 corners of the work in the

6 townships on Martha's Vineyard has involved 38 triangle sides, 19 reductions of eccentric stations to centre, 35 L.M.Zs. and 35 inverses. The revision and verification of the work in Bristol County has involved the computation of 20 reductions of eccentric stations to centre, 124 L.M.Zs., 78 triangle sides and 25 inverses. Similar work in Plymouth County has involved the computation of 19 triangle sides, 30 reductions of eccentric stations to centre, 8 L.M.Zs. and 6 inverses. The geographical positions of 18 triangulation stations in the Connecticut River valley have been computed, involving 44 triangle sides, 9 reductions of eccentric stations to centre, and 21 L.M.Zs.

The corrections in the card catalogue of geographical positions, which have been made conjointly with Mrs. Peirce, have involved 1,230 computations of 615 stations. In addition to the above work, miscellaneous computations have been made, of which the following is an approximate record: 53 L.M.Zs., 60 triangle sides, 64 inverses and 72 reductions of eccentric stations to centre.

Within the present year the work of the draughting department of the office has been placed in the charge of Mr. Frank L. Tibbetts, who has ably and efficiently performed the varied

duties appertaining to it, in arranging the order of work and collecting the necessary data from the results of the field surveys. We submit Mr. Tibbetts' report to the commission in relation to his work.

Mr. HENRY L. WHITING, *Chairman*.

SIR: — I have the honor to submit the following report of work done in the draughting department during the year 1896. The work done covers territory in the following counties: Essex, Suffolk, Middlesex, Dukes, Bristol, Plymouth and Barnstable.

The following 11 town boundary atlases were carefully revised preparatory to publication, and printed during the year: Salem, Manchester, Marblehead, Arlington, Gloucester, Beverly, Nahant, Melrose, Rockport, Wenham and Danvers.

During the year there have been added to the above number the following 26 cities and towns, which will be published as soon as practicable: Acushnet, Barnstable, Chilmark, Cottage City, Dartmouth, Edgartown, Everett, Fairhaven, Falmouth, Gay Head, Lynn, Lynnfield, Malden, Mattapoisett, Medford, New Bedford, Peabody, Revere, Saugus, Stoneham, Swampscott, Sandwich, Tisbury, West Tisbury, Winchester and Woburn.

In addition to these matters and the work incidental to the conduct of the draughting department, I have done personally the following work:—

Finished 12 atlases, viz.: Malden, Stoneham, Lynnfield, Barnstable, Cottage City, West Tisbury, Everett, Winchester, Mattapoisett, Dartmouth, Tisbury and Chilmark; triangulation plan representing Mr. Peirce's work in the field for the season of 1895, comprising 16 cities and towns in the Connecticut River valley; plan showing Mr. Tolley's work in the field, season of 1896; plan showing primary triangulation between the Connecticut River valley and the Atlantic Coast; plan of Martha's Vineyard, showing Mr. Tolley's field work in that locality and the "Marr" triangulation; 5 plans, embracing 3 triangulation stations and 20 town corners, for transmission to the U. S. Coast Survey Department at Washington; plan of the "Old Colony Line" from Accord Pond to North Attleborough-Wrentham Corner 1; drawing made for uniform title page, designs for which have been accepted by the commission and engraved for use with each atlas; plans showing the boundary lines between Hingham, Cohasset, Norwell and Scituate, showing the proposed straightening of the same and the incidental elimination of 21 town corners. Special work has been done

on plans of the following triangulation stations for transmission to the U. S. Coast Survey Department at Washington: Wachusett, Ayers Hill, Mugget, Pigeon Hill, Fays Mountain, Gibbet, Holt, Maynard, Marlborough Water Tower, Castle Hill, Pearl Hill Observatory, Cross's House Pole, Robins Hill, Watatick, Lunenburg Hill and Miscoe Hill. I have also made a plan showing the topography of the water-shed between the Concord, Charles and Sudbury rivers.

Further work done in the draughting room appears in the reports of Mr. Yendell and Mr. Farnum, which are hereby appended.

Extract from Mr. Yendell's Report.

MR. HENRY L. WHITING, *Chairman.*

SIR: — I have the honor to report my work for this commission during the year 1896 as follows: —

January: revised 8 atlases, viz., Beverly, Wenham, Danvers, Gloucester, Rockport, Peabody, Salem and Marblehead; finished 1 atlas, viz., Marblehead. February: revised 1 atlas, viz., Swampscott; finished 3 atlases, viz., Swampscott, Nahant and Lynn. From March 1 I was on leave of absence.

Extract from Mr. Farnum's Report.

Mr. HENRY L. WHITING, *Chairman*.

SIR: — I have the honor to report the following list of atlases drawn by me during the year 1896: Medford, New Bedford, Acushnet, Fairhaven, Saugus, Revere, Edgartown, Sandwich, Falmouth, and Gay Head.

Mrs. Edna M. Peirce has continued her efficient service for the commission in her usual systematic and accurate manner. Her duties have been varied and responsible. She has assisted in duplicating, with Mr. Tolley and Mr. Hawley, the most important computations, which are always carefully compared and verified by two computers, working conjointly. This system of duplicate computing by two computers, working conjointly, was adopted in 1890, at the advice of Prof. Charles A. Schott, chief of the computing department of the United States Coast and Geodetic Survey.

Mrs. Peirce has also kept the accounts and books of the commission, and had charge of the sale of the portfolios and single sheets of the State topographical map, and deposited the money received therefrom with the State treasurer. She has also done much of the typewriting and attended to other work of the office. We give below

Mrs. Peirce's report to the commission in regard to her duties: —

Mr. HENRY L. WHITING, *Chairman.*

SIR: — I herewith submit a report of the office work done by me for the year 1896: 109 traverse lines straightened in duplicate, conjointly with Mr. Tolley and Mr. Hawley; 241 eccentric stations reduced to centre in duplicate, conjointly with Mr. Tolley and Mr. Hawley; 410 triangle sides computed in duplicate, with Mr. Tolley and Mr. Hawley; 414 L.M.Zs. computed in duplicate, with Mr. Tolley and Mr. Hawley; 75 inverse computations made in connection with above, in duplicate, conjointly with Mr. Tolley and Mr. Hawley; 1,230 computations made to determine the lengths of seconds in metres of latitude and longitude of the triangulation stations for the card catalogue, conjointly with Mr. Hawley. Triangulation plotted on 15 town plans. Made abstract and duplicate abstract of 7 field books of 1896 work. Made duplicate abstract of the primary angles of the 1895 work. Made duplicate copies of 37 field books. Revised duplicate copies of 90 field books, conjointly with Mr. Hawley. Revised the lines of 25 towns, making them complete and ready for the draughting room, conjointly with Mr. Hawley. General office work.

The commission would again restate the fact that, as the work of the boundary line survey has become more generally known and its accuracy tested by persons having to do with the various public works in connection with which its results are of value, the application for information in regard to it has much increased, and the work of responding to these calls has become quite an item in the operations of the office. In record of the amount of data furnished during the year 1896 the following statistics are submitted, and show the wide range of useful purposes to which the accurately determined results of this State work can be and are being applied:—

*Office Data Given to Public Boards, Engineers
and Other Parties During the Year 1896.*

METROPOLITAN PARK COMMISSION.

Azimuth from Echo Bridge to Doublett East Hill, Needham Water Tower and Boston State House, also latitude and departure of Echo Bridge in relation to the Boston State House.

Courses and distances from Echo Bridge to Needham corner 4 and from Needham corner 4 to Needham corner 3.

BOSTON & ALBANY RAILROAD.

Azimuth and distance from Mt. Auburn Tower to Prospect Waltham.

Geographical positions of three Newton corners with azimuth and distance between.

F. P. JOHNSON, city engineer of Waltham.

Positions, azimuths and distances of the corners of Waltham.

JOHN N. McCLINTOCK, C. E., Boston.

Positions, azimuths and distances of the corners of Wellesley, also positions of eleven triangulation points in the vicinity.

Tracing of the outline of the town.

C. W. HOWLAND, C. E., Rockland.

Positions, azimuths and distances of all the corners of the following towns: Hanover, Hanson, Whitman, Marshfield and Norwell.

Positions of 2 Kingston corners and 4 Halifax corners.

WILLIAM J. HOWARD, C. E., Whitman.

Positions, azimuths and distances of all the corners of West Bridgewater which have been determined.

STATE BOARD OF HEALTH.

Positions of 6 Norwood, 7 Brockton, 4 Foxborough, 5 Dover, 4 Needham, 2 Wellesley, 19 Newton, 1 Waltham, 13 Brookline, 3 Randolph, 2 Easton and 1 Mansfield corners.

Positions of all the corners in Essex, Suffolk and Middlesex counties which have been determined.

Tracings of town plans of Salem, Peabody, Walpole, Norwood and Sharon.

Tracings of part of the original Duxbury sheet and also from the original sheets of the Concord River in the towns of Concord, Bedford and Billerica.

RICE & EVANS, engineers, Boston.

Azimuth and distance between Middleborough corner 2 and pasture.

WINSLOW L. WEBBER, city engineer of Gloucester.
Positions, azimuths and distances of all the corners of Gloucester.

F. T. FULLER, Weston.
Tracing of portion of the original Framingham sheet.

F. HERBERT SNOW, city engineer of Brockton.
Tracing of plan of the Old Colony line.
Positions of 3 preliminary points to aid him in determining the Brockton-West Bridgewater line.
Positions, azimuths and distances from corner to corner on the new Brockton-West Bridgewater line.

N. SPOFFORD, C. E., Haverhill.
Positions of 6 corners on the Massachusetts and New Hampshire line.

Capt. ASA L. JONES, selectman of Harwich.
Tracing of the outline of the town of Harwich.

G. F. HARTSHORN, C. E., Woburn.
Tracing of the outline of the town of Woburn.

METROPOLITAN WATER BOARD.
Positions, azimuths and distances of all the corners of Sterling (preliminary computation and only approximate).
Latitude and departure of Bare Hill Observatory flag pole in reference to the Boston State House.
Positions of Boynton's Hill, Bare Hill Observatory flag pole, Stoneham Water Works and Columbus Park Observatory, and the azimuth and distance from these to the Boston State House.

WILLIAM T. OLIVER, Lynn.

Positions of all the corners in the boundary line between Essex and Middlesex counties.

HARBOR AND LAND COMMISSION.

Positions, azimuths and distances of 17 triangulation points in the Connecticut valley (computed especially for them and only approximate), also descriptions of the same.

METROPOLITAN SEWERAGE COMMISSION.

Tracing of the original Boston sheet and parts of the Boston Bay and Dedham sheets, also positions of all the corners of the following towns: Boston, Somerville, Cambridge, Medford, Belmont, Arlington, Malden, Watertown, Winchester, Woburn, Melrose, Stoneham, Lexington, Everett, Revere, Wakefield, Chelsea, Saugus, Burlington, Needham, Dedham, Newton, Hyde Park, Quincy, Brookline, Milton, Waltham and Winthrop.

WALTER H. FAUNCE, Kingston, Plymouth County Commissioner.

Positions, azimuths and distances of all the corners of Kingston.

C. E. WESTON, C. E., Middleborough.

Positions, azimuths and distances of the corners on the Carver-Middleborough line.

HYDE & SHERRY, engineers, Boston.

Tracing of the Mashpee-Sandwich line.

ARTHUR H. TUCKER, selectman of Milton.

Tracing of the town plan of Milton.

E. WORTHINGTON, C. E., Dedham.
Positions, azimuths and distances of the corners of Dedham.

JAMES A. BANCROFT, C. E., Reading.
Positions, azimuths and distances of the corners of Wakefield and Reading.

T. A. CHUBBUCK, C. E., Middleborough.
Azimuths and distances on the Carver-Wareham line.

Professor CROSBY, M. I. T., Boston.
Positions of the corners of the following towns : Braintree, Weymouth, Quincy, Hingham, Avon, Rockland, Abington, Holbrook, Randolph and part of Brockton.

WHITE & WEATHERBEE, engineers, Braintree—Brockton.
Positions of the triangulation points in Braintree, also positions, azimuths and distances of the corners of Braintree.

CITY OF BOSTON, street department.
Azimuths and distances between 3 Cambridge, 2 Arlington and 3 Dedham corners.

C. E. STEVENS, Dudley.
Tracing of the original sheet in the vicinity of Southbridge.

Summary of Field Work.

Primary Triangulation.

Signals built,	.	.	.	.	.	.	.	13
Angles measured,	.	.	.	.	.	.	.	7,719
Trigonometrical stations occupied,	.	.	.	.	.	.	.	12
Trigonometrical stations determined,	.	.	.	.	.	.	.	11
Trigonometrical stations permanently marked,	.	.	.	.	.	.	.	11

Secondary Triangulation.

Town boundary points revised and verified, . . .	256
Town boundary triangulation stations reoccupied, . .	122
Triangulation stations other than boundary points verified,	561
Triangulation stations permanently marked, . . .	21

*Summary of Office Work.**Mathematical Department.*

Eccentric stations reduced to centre,	540
Traverse lines straightened,	218
Triangle sides computed,	901
L.M.Zs. computed,	1,009
Inverses computed,	404
Field books revised,	180

Draughting Department.

Triangulation plans drawn,	37
Town corners plotted,	577
Triangulation stations plotted,	638
Lettered descriptions of town corners, with topographi- cal sketches,	398
Lettered descriptions of triangulation stations, . .	142
Geographical positions of town corners listed, . .	411
Geographical positions of triangulation stations listed, .	184
Total number of atlas sheets finished,	190

Miscellaneous.

The following table shows, approximately, the items of information given out from the office since Jan. 1, 1894: —

Data Furnished.

YEAR.	Positions.	Azimuths.	Distances.	Plans.
1894,	900	140	140	25
1895,	700	260	260	25
1896,	1,450	250	250	15
Total,	3,050	650	650	65

The call for this data has been principally from State and city boards, as Harbor and Land Commission, State Board of Health, Metropolitan Water Board, Metropolitan Park Commission, Metropolitan Sewerage Commission and the U. S. Coast Survey.

Publication.

The following 11 city and town boundary atlases were carefully revised, prepared for publication and have been printed, under contracts with the Forbes Lithograph Company of Boston, as stated in previous reports: Arlington, Danvers, Manchester, Melrose, Rockport, Beverly, Gloucester, Marblehead, Nahant, Salem and Wenham. These atlases will be ready for distribution on and after March 1 of the coming year 1897.

During the year there have been added to the above the following 26 towns, which will be published as fast as practicable: Acushnet, Barnstable, Chilmark, Cottage City, Dartmouth, Edgartown,

Everett, Fairhaven, Falmouth, Gay Head, Lynn, Lynnfield, Malden, Mattapoisett, Medford, New Bedford, Peabody, Revere, Saugus, Stoneham, Swampscott, Sandwich, Tisbury, West Tisbury, Winchester and Woburn.

Topographical Survey and Map.

Under the provisions of chapters 95 and 393 of the Resolves of 1894, during the present year of 1896, 24 atlases and 1,414 single sheets of the State topographical map have been sold, for which the sum of \$356.10 has been received, and 6 sections of the wall map sold for \$1.50, amounting in total to \$357.60, which sum has been turned into the State treasury.

Under the provisions of chapter 95 of the Resolves of 1891, 2 portfolios of the State map have been gratuitously distributed.

Financial.

For the expenses of the year now closed, 1896, the commissioners have received, under appropriations by the General Court, the following amounts for the purposes indicated: —

Determination of boundary lines,	. . . . .	\$11,000
Marking boundary lines,	. . . . .	500
Selling and distributing maps,	. . . . .	1,000
Supplementing topographical map and levelling,	. . . . .	500
Instruments, repairs, etc.,	. . . . .	100
Duplicating atlases of town boundary plans,	. . . . .	2,000

The commissioners have submitted the same estimates for the ensuing year of 1897, with the exception of recommending an addition of \$3,000 to the fund for the general operations of the field and office, heretofore limited to \$11,000, for the following reasons, as submitted to the State Auditor:—

“The increase of \$3,000 for the regular progressive work of the commission, as authorized by chapter 49 of the Resolves of 1885 for the determination of city and town boundary lines, is requested for the reason that the extent and condition of this work requires inspection and verification. This work has heretofore been done by Mr. C. H. Van Orden of the United States Coast and Geodetic Survey, whose services have been paid by that department of the general government. Mr. Van Orden has since severed his connection with the State Commission, and, as no other United States officer is now available, the commission is forced to ask for a substitute to perform this duty. An increase in the draughting force of the office will be of advantage to the work of the commission.”

The expenses necessary for the other branches of the State survey remain the same as estimated and appropriated for the preceding year of 1896.

The following is a summary of the form in which the estimates for 1897 have been submitted: —

APPROPRIATIONS — FOR WHAT REQUIRED.	Estimates for 1897.	Citation of Statute Provisions relating to Expenditures.	Amounts Appropriated for 1896.
Determination of boundary lines.	\$14,000	Resolves of 1885, chap. 49.	\$11,000
Marking boundary lines, .	500	Acts of 1888, chap. 836.	500
Selling and distributing maps,	1,000	Resolves of 1890, chap. 57.	1,000
Duplicating topographical maps and levelling.	500	Resolves of 1893, chap. 11.	500
Instruments, repairs, etc., .	100	Resolves of 1893, chap. 11.	100
Duplicating atlases of town boundary plans.	2,000	Resolves of 1894, chap. 18.	2,000

Legal Questions.

The work of the commissioners has been sometimes embarrassed on account of the objection and refusal of persons to allow the engineers employed by this commission to enter upon private grounds and to erect signals at places which it is important to occupy. In consequence of some cases of serious difficulty during the past season, the commissioners asked the Attorney-General for an opinion as to their rights in connection with this matter, to which the Attorney-General has made the following reply: —

COMMONWEALTH OF MASSACHUSETTS,
OFFICE OF THE ATTORNEY-GENERAL, BOSTON, Dec. 19, 1896.

Prof. HENRY L. WHITING, *Chairman Topographical Survey Commission.*

DEAR SIR:—I have the honor to acknowledge the receipt of your letter of December 7, requesting, among other things, my opinion upon the following question:—

“Under the act under which this commission is now acting, have we authority to enter private grounds in making the survey?”

The first authority given to your Board was under Resolves 1884, chapter 72, under which provision was made for a commission “to confer with the director or representative of the United States geological survey, and to accept its co-operation with the Commonwealth in the preparation and completion of a contour topographical survey and map of this Commonwealth hereby authorized to be made.” By Resolves 1885, chapter 29, an appropriation was made for “the determination of triangulation of the boundary lines of the cities and towns in the Commonwealth,” the work to be done under the direction of the commission. Additional appropriations have been made from time to time for the same purpose. By Statutes 1888, chapter 336, the commission was authorized to propose changes in boundary lines of contiguous

towns, and to locate and define the changes made, and to place monuments for such lines.

The performance of the duties imposed by these statutes obviously makes it necessary for the commissioners from time to time to enter upon private lands. No such authority is given in terms in any of the statutes; but when an act of the Legislature imposes duties upon a public officer, it confers upon him by implication whatever authority is necessary to the performance of such duties.

The commission and its agents are public servants, authorized by statute to make a survey and map of the Commonwealth, and to establish boundary lines between towns. In the discharge of their duties as such, it may become necessary to enter temporarily upon private lands. If the entry is reasonably necessary, and is but temporary in its nature, and is accompanied by no damage, such an entry does not constitute a trespass, but is within the authority of the commissioners. (*Winslow v. Gifford et al.*, 6 Cush. 327, *via* also *Cavanaugh v. Boston*, 139 Mass. 426, 435; *Brigham et als. v. Edmans*, 7 Gray 359, 363.)

The foregoing opinion renders it unnecessary to consider the other questions in your letter.

Yours very truly,

(Signed) HOSEA M. KNOWLTON.

Attorney-General.

In order to illustrate the practical application of the results of the State town boundary survey and the value of the methods used in its execution, the commissioners have appended to their report a plan, showing the deviation from a straight course of the actual location of the “Old Colony Line,” so called, which extends from a point, or “bound,” on the westerly shore of Accord Pond, near the junction of the towns of Hingham, Norwell and Rockland, and also the junction of Plymouth and Norfolk counties, to a point or “bound” at the angle in the line between the towns of North Attleborough and Wrentham, and in the line between Norfolk and Bristol counties. The length of this line is 144,439.8 feet, or 27.35 miles.

When the question came up of determining the points in this “Old Colony Line,” independently of any town boundary line that might be identical with it, the commissioners and their engineers were assured, by parties who professed to have knowledge regarding it, that it was a “*perfectly straight line*,” as originally located, and subsequently tested by later surveys, and that the monuments set along in the line would so define it.

The practice of the commission has been not to accept other work than their own, and in this instance the “Old Colony Line,” as defined by its markings, was determined in the usual method of

our town boundary triangulation. This work rests upon the established bases of the primary triangulation of the United States Coast and Geodetic Survey; the stations of this government work within the territory of Massachusetts, including the accurate base line measured by that department on Seekonk plains, are a part of the system of this comprehensive work, which extends from our southern boundary with Mexico to our northern boundary with the British Provinces.

We submit our plan of the "Old Colony Line," with the confidence that it will stand the test of thorough investigation.

In closing their report, your commissioners desire to record the efficient service rendered by the members of their engineer corps, all of whom have performed the various duties assigned to them, both in the field and office, in a most satisfactory manner. It is also gratifying to note the interest taken in the results of the survey, by State and city boards, by engineers and other citizens interested in this, the first accurate definition and determination of the municipal subdivisions of the Commonwealth.

Very respectfully submitted,

HENRY L. WHITING.

DESMOND FITZGERALD.

ALFRED E. BURTON.





PUBLIC DOCUMENT

. . . . No. 53.

THIRTEENTH ANNUAL REPORT

OF THE

CIVIL SERVICE COMMISSIONERS

OF

MASSACHUSETTS.

DECEMBER 4, 1896.

BOSTON:

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Commonwealth of Massachusetts.

To the Honorable the Senate and House of Representatives in General Court assembled.

Pursuant to the provisions of section 2 of chapter 320 of the Acts of the Legislature for 1884, the Civil Service Commissioners have the honor to submit their thirteenth annual report, including the period from Oct. 1, 1895, to Oct. 1, 1896.

Upon the expiration of his term of office, in July, Commissioner Lord was reappointed, and there has been no change in the personnel of the commission. In January, George H. Johnson, who had succeeded to the office of registrar of labor, created by the Legislature in 1895, died, and suitable notice was taken by the commissioners of his long and faithful connection with the labor service under civil service rules. William L. Hicks, who had long been connected with the Boston Board of Health, and a veteran of the war of the rebellion, was appointed to the vacant position.

During the year covered by this report there was no change in the civil service rules, in the classification of the public service or in the regulations concerning appointment to it. There has been a steady increase in the number of applicants for examination, especially in the number of women. The commissioners repeat the statement made in their last report, that "this increase is the strongest argument in proof of the continued belief of the Legislature, the people and seekers for public employment in the efficiency, wisdom and fairness of the present system. Year by year

since 1884 the tendency and effort both of the Legislature and appointing officers have been to increase, and never to lessen, the labors imposed upon the commissioners and their able and efficient officers."

During the official year, 183 examinations of applicants for appointment in the first division of the classified service have been held. Of these, 99 were general competitive examinations, 3 were special competitive and 81 were non-competitive examinations. Of these 81 non-competitive examinations, 63 were in cases of promotion. In the other cases no eligible list for the office existed.

During the year 2,804 persons were examined, as compared to 2,613 the previous year. Of these, 2,031 were men, including 32 veteran soldiers or sailors, and 773 were women. There were 334 more women examined than during the previous year, showing the still growing desire of women to seek employment under the present civil service system, and the inclination of appointing officers to employ them in the clerical service. This inclination may be partly due to the veteran preference provided by present legislation.

Of the persons examined, 1,677 passed the examination, and their names were placed upon the appropriate eligible lists, from which certifications for appointments have been made. Of the persons examined, 2,767 have had a common school education and 37 have attended college. The number appointed from the eligible lists was 647, of whom 525, including 9 veterans, were men and 122 were women. There were also appointed without examination 116 veterans under the soldier exemption law. The average age of the applicants examined was about 38 years, and of those passing the examinations 36.59 years,—a continued proof that, under the scheme of examination provided, experience and common knowledge count for more than recent graduation from or study at school. The examinations have been practical, adapted wholly to test the qualification of the applicant for the office sought, and have resulted, as these figures show, in bringing to the top of the eligible lists those who have proved themselves in open and fair competition to be the best fitted for, and, therefore, under free government, the best entitled to the office created and paid for by the people.

THE LABOR SERVICE.

The labor service of Boston, Cambridge, New Bedford, Newton and Everett is classified and administered under civil service rules.

In Boston 3,230 men were registered during the year, including restorations from former registration. Of this number, 339, or a little over ten per cent., were veterans. One hundred and eight requisitions were received, and 106 certifications of men for employment, containing 2,365 names, were made. Of those so certified, 442, or nearly 19 per cent., were veterans, and 1,923 were not.

In Cambridge the total registration was 854, of whom 38 were veterans, 39 requisitions were made, and 869, including 32 veterans, were certified for employment.

In New Bedford 341 names were added to the register; 289 men, including 13 veterans, were certified upon requisitions. The 13 veterans and 156 others were employed.

In Newton 471 men, including 6 veterans, were registered, and 14 requisitions were made, upon which 447 names were certified, including 2 veterans.

By vote of the city council of Everett the labor rules and system were applied to that city early in the year, and, from the returns for the period of nine months preceding October 1, it appears that 122 men were registered, of whom 7 were veterans; 83 men were certified upon requisitions, of whom 4 were veterans.

A more detailed statement of facts and figures regarding the labor service appears in the report of the registrar of labor, in the Appendix.

EXTENSION OF CLASSIFIED SERVICE.

While there was no change in the classification of the public service under civil service rules during the year covered by this report, the commissioners take this opportunity of reporting to the Legislature amendments of civil service rules recently approved by the Governor and Council (Dec. 3, 1896); and which, under the law, will take effect upon Feb. 15, 1897.

These amendments are published in the Appendix, and are

here referred to under appropriate heads. The first and second amendments provide an extension of the classified service to include messengers in city service, superintendents and assistant superintendents not exempted by statute, civil engineers, draughtsmen and other employees of the city engineer, and the aids of the State Fire Marshal. This extension has been made after careful consideration and consultation, with a desire on the part of the commissioners to act conservatively, and at the same time to recognize the public demand that "the classified service should be extended whenever it is possible." It is felt to be both possible and advisable to make this extension.

The inclusion of messengers in the classified service is justified by the increase in number and compensation, especially in the city of Boston. When the rules were adopted, in 1884, the number of messengers was small, their duties understood and their pay such as would hardly invite competition. After the classification of clerks and other employees, excluding messengers, there developed an inclination to increase the number of messengers and to substitute them for clerks in some city departments. It is difficult to follow such messengers in the performance of their duties, or to restrict them to duties not clerical. It is simpler and easier to include them with clerks in the classified service.

As showing the increase in the number of messengers in the service of the city of Boston, attention is called to these statistics : —

	Number Messengers employed.	Aggregate Pay.	Average Pay.
1890,	19	\$12,840 00	\$675 00
1893,	32	25,165 00	786 00
1895,	46	36,405 00	791 00
1896,	47	37,635 00	800 00

No similar increase is noticed in other branches of the public service, and no reason is known to the commissioners

why in the last five years the public service of Boston has required an increase in the number of messengers from 19 to 47, at an added expense to the taxpayers of the city of some \$25,000.

While the duties of messengers are somewhat varied, and to be learned from experience, the commissioners feel that they will have no difficulty in providing a suitable and fair scheme for testing, by competitive examination, the qualifications of persons seeking such employment. Under the present veteran preference, the classification of messengers will give the veterans the benefit of the statute preference, and in a class of public service in which many of them might desire and be well fitted for employment.

As the pay of some messengers is too small to invite competition, the commissioners provide, by adding section 2 to Rule XXXVIII, that, whenever the pay does not exceed \$400 a year, the commissioners may, in their discretion, allow appointment without examination. In such cases, however, such appointee gains no right to promotion or transfer until after at least two years of service. This will prevent the appointment at small pay with the object of increasing it, or promoting the messenger without examination.

The commissioners deem it expedient to except from the classification of messengers one messenger to the mayor in each city. It is possible that such a messenger may have such confidential duties or stand in such a relation to the mayor that the latter should have the absolute right to appoint, just as he now has the right by statute to appoint his secretary and confidential stenographer.

Amendment *second* extends the classified service under the present Schedule B (Rule VI), by adding three additional classes. Class 12 will include superintendents, assistant superintendents, deputies and other persons, under whatever designation, performing any of the duties of a superintendent in any city. The statute, chapter 95 of the Acts of 1893, exempts from classification heads of any principal departments of a city. Since the inclusion a few years ago of foremen and sub-foremen, under Class 6 of Schedule B, there has been a tendency to enlarge the number of so-called superintendents having duties substantially similar to those of

foremen. While the commissioners, with the assistance of the Attorney-General, have attempted to define the difference between a foreman and a superintendent, the distinction is often difficult, and the line between the two classes of officials sometimes vague. It will be for the public advantage to include both classes under the rules, and the commissioners feel that it will not be difficult to frame a suitable scheme of examination for both. The necessary qualifications for each can be easily learned, and fairly tested in open competition.

Class 13 includes the engineers and employees in the office of the city engineer in each city. These employees are mostly persons of scientific training or experience in engineering work. In the city of Boston there are some seventy in this branch of the public service, with an annual pay aggregating over \$60,000. It is considered possible and advisable to extend the protection of the civil service rules and system to these public positions. As vacancies occur, they will be filled by competitive or appropriate examination, as the case may require. It will not be difficult in this class to test by examination the qualifications of applicants for it.

Class 14 includes the aids of the State Fire Marshal. At present there are twelve aids throughout the Commonwealth, whose duties are somewhat similar to those of the members of the detective division of the district police, and whose qualifications can be ascertained by similar examination.

THE VETERAN PREFERENCE.

Attention was called in the last report to the petition for mandamus filed in the supreme judicial court by Frederick W. Brown, an applicant upon the eligible list for the detective division of the district police force, to compel the commissioners to restore and keep his name at the head of the eligible list, in preference to an unexamined veteran on the list. The suit involved the constitutionality of certain provisions in the veteran preference act, chapter 501 of the Acts of 1895, requiring the certification and appointment to any position in the classified service of any veteran soldier or sailor, whether examined or not, in preference to any examined person not a veteran upon the eligible list. The case

was ably and elaborately argued in November, 1895, by learned council for the petitioner, and by the Attorney-General in support of the law and the action of the commissioners under it. The court held the matter under advisement until April last, when an opinion was rendered granting the writ of mandamus, compelling the restoration of the name of the petitioner to its place at the head of the list. While the opinion is an able and exhaustive discussion of the constitutionality of veteran preference legislation, the court carefully confined its decision to the declaration that the Legislature could not compel an appointing officer to appoint to a public office (the district police force) persons of a certain class in preference to all others, without the exercise of any discretion and without proper determination of qualification. The questions argued regarding the constitutionality of requiring preference of veterans who pass the examination, or of allowing appointment of veterans without examination in the discretion of the appointing officers, were not then decided, as a decision of them was not necessary upon the finding of the court. The opinion is printed in the Appendix.

Under this decision it became necessary to amend the veteran preference law, and this was done by chapter 517 of the Acts of 1896. This act repeals, or codifies, all previous existing legislation, and provides in clear language for two preferences to the veteran: *first*, by section 2, a veteran who passes the examination must be appointed in preference to any person (except women) not a veteran, without regard to his relative position upon the eligible list; *second*, by section 3, appointing officers may, in their discretion, appoint a veteran, whether examined or not, to any position in the classified service.

As the question had been raised and argued regarding the constitutionality of these provisions, and the court had left it still open to future litigation and resulting confusion and delay in settlement, the Governor and Council, at the request of the commissioners, and for the interest of all concerned, required the opinions of the justices of the supreme judicial court upon rules framed under the new statute. The justices were divided in opinion, a majority (four) holding that the entire act, as they construed it, was constitutional, a minority

(three) were of the opinion that the Legislature could not enact that veterans must be preferred for public office or employment to others who may have higher standing or superior qualifications. The justices were unanimous in holding that the exemptive provisions of the act, allowing appointment of veterans in the discretion of the appointing officer, were constitutional. The division in opinion of the justices justified the action of the commissioners in taking this means of settling finally and by judicial authority the power of the Legislature. The conclusion from these judicial decisions and opinions, taken together, is that the Legislature can provide that preference shall be given to a veteran qualified for the position, but no law or rule can oblige the appointment to a public office or employment of a veteran not qualified for its duties. The opinions of the justices are printed in the Appendix.

This statute and the opinions of the justices under it required the commissioners to amend the rules to give to the veteran all the rights secured by law. These amendments have been approved by the Governor and Council, and are reported herewith. The new Rule XXVII provides that, upon requisition, the commissioners shall certify, in preference to all others not women, the veterans upon the eligible list of examined applicants, and the appointment must be made from the names so certified. In this way the appointment of the veteran becomes compulsory. While any veteran can be appointed, no person other than a veteran, if there is any on the list, can be appointed.

The right of the veteran to appointment without examination, in the discretion of the appointing officer, is fully recognized by Rule XII and section 3 of Rule XXVII, under which the appointing officer can at any time call for any or all veterans registered for appointment without examination, and appoint any of them to the vacant position.

There was more difficulty in regulating the preference in the labor service. The justices seem to be of opinion that the statute must be construed to mean that the commissioners shall ascertain the fitness of veterans applying for public labor before compelling their appointment under section 6 of the preference act. As no competitive examination is

required or practicable in the labor service, provision to meet the suggestions of the justices is made under Rule XLV, as now amended.

Every applicant for labor, in addition to his declaration under oath, must file a certificate signed by two reputable citizens that he is qualified to perform the labor sought. It is further provided that the commissioners may, in their discretion, require a physical examination of the applicant, and failure to pass it will exclude him. Having by these provisions guarded against the employment of incompetent laborers, the commissioners give the statute preference to veterans in that branch of the public service by providing, in sections 5 and 7 of Rule XLV, that upon requisition from a department they will certify all veterans on the register, and the selection must be from the list so certified, until the list of qualified veterans is exhausted.

It is further provided, under authority of section 6 of chapter 517 of the Acts of 1896, that, where the appointing officer shall certify that the labor requires the services of young and vigorous men, and designates a maximum age limit, the commissioners, if satisfied of the truth of the certificate, may recognize such age limit.

It is believed that by these provisions the commissioners have carried out the intention of the statute, and that, under the decision and in the opinion of the supreme court, that statute has gone as far as is possible, under our Constitution, to secure the employment of veterans in the public service. The statute of 1896 was carefully framed, and has been carefully examined and construed by our highest judicial tribunal. The commissioners, at the close of a protracted discussion, involving debate and enactment of law in the legislative halls, its consideration and veto in the executive chamber and its final submission to the judicial authority, trust that the policy of the Legislature, as represented by the act of 1896, and the new civil service rules to enforce it, may be accepted as final. They can see no benefit to the public service in pressing, on the one hand, to an unconstitutional enactment the preference, or, on the other, in reopening the question of the expediency of legislation which it must now be assumed represents the will and wishes of the people of the Commonwealth.

AMENDMENTS TO LABOR RULES.

The thirteenth amendment to the rules provides, among other things already referred to, three important changes in the administration of the labor system.

First. — Section 10 of new Rule XLV provides that a mechanic or laborer who has been on the suspended list for six months must be regarded as out of the service, and cannot be employed without new registration and certification. It has been more or less customary in some of the labor employing departments to call for laborers, put them upon the rolls and then suspend them. It would be possible in this way to employ, at least nominally, any number of men upon our lists, and then actually put to work any of them in the discretion of the employing officer, and place the others without pay upon the suspended list. In this way, without expense to the city, a department could disregard the veteran preference, or other preferences in selection, and employ in actual work whom it pleased. The system of keeping large lists of suspended laborers is unnecessary, unfair to the men and detrimental to good and efficient municipal government. If a laborer is needed as a public employee, he should be put to work, and at the close of the work be discharged with credit. He can then return to the labor office and again register with added preference for experience and good work. His rights are as fully protected as they are by placing him upon a suspended list, from which he may or may not again be called to city work, at the option of the employing officer.

The commissioners have fixed the period of allowed suspension at six months. This seems a liberal allowance. If for six months the city has found no work for the laborer, it is just to him and better for the service to give him an honorable discharge.

Second. — Section 11 provides that laborers certified must be employed at least two months before they can be transferred to other work. Under the present rules, it is possible to call men for expert labor for which no persons have registered. The department can then select from the outside whom it pleases. If the men so selected, under claim that they are needed for special expert work, are at once trans-

ferred to general work for which there are competent men enrolled under the preference provided by law, an injustice is done to the latter, and an opportunity afforded for the evasion of the civil service law. The department, when it specifies the work, should be held to the specification, at least for two months. If it finds that it does not need the men for the special work called for, it can discharge them and call upon the commissioners, as necessity requires, for suitable laborers for the work actually required.

Third. — Section 12 applies to the labor service the same rule (Rule XL) now applied in the other division of the public service, by allowing the reinstatement of a laborer found to have been dismissed without cause. It is proposed to allow such reinstatement within three months. This seems to the commissioners to allow a proper time in which the laborer can seek redress for any unjustified dismissal, and at the same time to protect the labor service from any abuse of the rule.

CHAS. THEO. RUSSELL,
ARTHUR LORD,
EDWARD P. WILBUR,
Civil Service Commissioners.

APPENDIX.

APPENDIX.

EXAMINATIONS AND APPOINTMENTS.

From Oct. 1, 1895, to Sept. 30, 1896, inclusive, there were held for the State and Boston services 78 examinations, as follows: —

COMPETITIVE EXAMINATIONS.

For State clerical service,	6
For Boston clerical service,	4
For State stenographer and type-writer service,.	2
For Boston stenographer and type-writer service,	2
For State prison service,	1
For Boston prison service,	1
For Boston fire service,	3
For district police service,	1
For Boston police service,	3
For Boston draw-tender and assistant draw-tender service,	1
For Boston foreman and sub-foreman service,	3
For Boston inspection service,	3
For Boston school janitor service,	1
For Boston truant officer service,	1
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NON-COMPETITIVE EXAMINATIONS.

For State clerical service,	1
For State clerical promotion,	2
For Boston clerical promotion,	1
For State stenographer and type-writer service,.	3
For Boston plumbing inspection service,	1
For Boston fire promotion,	32
For Boston police promotion,	4
For Boston assistant draw-tender promotion,	1
For Boston sub-foreman promotion,	1
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There have been held 105 examinations for original appointments and promotions in the clerical, stenographer and type-writer, police, draw-tender, foreman, inspection, fire

and janitor services of cities other than Boston, and for plumbing inspection service in cities and towns, under chapter 455, Acts of 1894, as follows:—

APPENDIX.

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						Number of Examinations.	Number Examined.
Fitchburg : —							
Clerical service,	1	13
							— 13
Gloucester : —							
Police service, .	.	.	.	.	.	1	7
							— 7
Haverhill : —							
Clerical service, .	.	.	.	.	.	1	4
Police service, .	.	.	.	.	.	1	9
Police promotion, .	.	.	.	.	.	1	1
							— 14
Holyoke : —							
Police service, .	.	.	.	.	.	1	14
Police promotion, .	.	.	.	.	.	1	1
Foreman service, .	.	.	.	.	.	1	2
Janitor service, .	.	.	.	.	.	2	27
							— 44
Lawrence : —							
Clerical service, .	.	.	.	.	.	2	10
Police service, .	.	.	.	.	.	1	24
Foreman service, .	.	.	.	.	.	1	2
							— 36
Lowell : —							
Clerical service, .	.	.	.	.	.	1	25
Police service, .	.	.	.	.	.	1	58
Police promotion, .	.	.	.	.	.	1	1
Foreman service, .	.	.	.	.	.	2	17
							— 101
Lynn : —							
Clerical service, .	.	.	.	.	.	2	8
Police service, .	.	.	.	.	.	1	36
Police promotion, .	.	.	.	.	.	2	2
							— 46
Malden : —							
Plumbing inspection service, .	.	.	.	.	.	1	1
Police service,	1	22
Police promotion,	3	3
							— 26
Marlborough : —							
Police service,	1	7
							— 7

APPENDIX.

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The whole number of persons examined for original appointments and promotions in the first division is as follows : —

The whole number passed is as follows : —

For clerical service, 629, or 54.46 per cent. of those examined.
 For clerical promotion, 7, or 100 per cent. of those examined.
 For stenographer and type-writer service, 46, or 75.41 per cent. of those examined.
 For plumbing inspection service in cities and towns, 6, or 67 per cent. of those examined.
 For prison service, 43, or 84.31 per cent. of those examined.
 For fire service, 163, or 57 per cent. of those examined.
 For fire promotion, 27, or 84.38 per cent. of those examined.
 For district police service, 4, or 67 per cent. of those examined.
 For police service, 535, or 62.57 per cent. of those examined.
 For police promotion, 21, or 95.46 per cent. of those examined.
 For draw-tender and assistant draw-tender service, 24, or 80 per cent. of those examined.
 For assistant draw-tender promotion, 1, or 100 per cent. of those examined.
 For foreman and sub-foreman service, 95, or 79.17 per cent. of those examined.
 For sub-foreman promotion, 1, or 100 per cent. of those examined.
 For inspection service, 47, or 55.30 per cent. of those examined.
 For school janitor service, 16, or 27.12 per cent. of those examined.
 For truant officer service, 12, or 50 per cent. of those examined.

The whole number appointed from those examined is as follows : —

In the clerical service,	125
By promotion in the clerical service,	7
In the stenographer and type-writer service,	34
In the prison service,	2
In the fire service,	61
By promotion in the fire service,	26
In the district police service,	2
In the police service,	286
By promotion in the police service,	28
In the draw-tender service,	2
By promotion in the draw-tender service,	1
In the foreman and sub-foreman service,	28
By promotion in the sub-foreman service,	1
In the inspection service,	33
In the plumbing inspection service,	6
In the school janitor service,	5

The average age of all the persons examined is about thirty-eight years.

Of the 1,677 persons who passed the examinations, 27 were college educated.

The whole number of veterans who passed examinations for original appointment is 12; the whole number of original appointments of examined veterans is 9, or at the rate of about 75 per cent. of those who passed.

The whole number of veterans examined for original appointment is 32; the whole number passed is 12, or 37.50 per cent. of those examined.

The whole number of unexamined veterans appointed is 116.

Following are the figures on which this statement is based:—

COMMONWEALTH SERVICE.

	NUMBER OF EXAMINATIONS.			NUMBER EXAMINED.			NUMBER PASSED.			NUMBER APPOINTED FROM THOSE EXAMINED.			AVERAGE AGE OF THOSE PASSED.			AVERAGE AGE OF THOSE FAILED.			EDUCATION OF THOSE PASSED.		EDUCATION OF THOSE FAILED.	
	General Com- petitive.	Special Com- petitive.	Non-compet- itive.	Male Civilians.	Veterans.	Females.	Male Civilians.	Veterans.	Females.	Male Civilians.	Veterans.	Females.	Male Civilians.	Veterans.	Females.	Male Civilians.	Veterans.	Females.	Common School.	College.	Common School.	College.
State clerical service, . . .	6	-	1	153	8	373	60	2	238	1	-	57	24.48	55.00	25.11	27.46	58.50	24.60	287	13	231	3
State clerical promotion, . . .	-	-	2	-	-	2	-	-	2	-	-	1	-	-	82.00	-	-	-	2	-	-	-
State stenographer and typewriter service,	2	-	3	5	-	33	4	-	28	2	-	20	24.50	-	26.12	25.00	-	25.30	30	-	8	-
State health inspection service, .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
State prison service, . . .	1	-	-	34	2	-	81	2	-	-	-	-	36.26	49.00	-	34.00	-	-	33	-	3	-
District police service, . . .	-	*1	-	-	6	-	-	4	-	-	2	-	-	55.25	-	-	-	51.50	4	-	2	-
	9	1	6	192	16	408	95	8	265	3	2	78	23.41	53.08	27.74	28.82	55.00	24.95	356	13	244	3
	16			616			369			83			36.41			36.26			369		247	

BOSTON SERVICE.

Boston clerical service, . . .	4	-	-	177	2	131	48	-	63	5	-	1	25.75	-	22.94	28.09	55.50	28.74	105	6	186	3
Boston clerical promotion, . . .	-	-	1	1	-	-	1	-	-	1	-	-	24.00	-	-	-	-	-	1	-	-	-
Boston stenographer and type- writer service,	2	-	-	4	-	10	4	-	6	8	-	2	24.00	-	24.67	-	-	20.50	10	-	4	-

APPENDIX.

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Boston prison service,	1	-	-	14	1	-	10	-	2	-	9	34.10	-	42.75	51.00	-	10	-	5	
Boston fire service,	2	-	-	245	-	-	132	-	57	-	-	24.00	-	25.00	-	-	133	-	113	
Boston fire promotion,	-	-	33	33	-	-	27	-	26	-	-	35.60	-	49.00	-	-	27	-	6	
Boston police service,	3	-	-	367	-	-	141	-	123	-	-	27.63	-	28.16	-	-	120	2	136	
Boston police promotion,	-	-	4	4	-	-	4	-	10	-	-	40.00	-	-	-	-	4	-	-	
	1	-	-	26	-	-	21	-	2	-	3	35.63	-	42.25	-	-	21	-	4	
	-	-	1	1	-	-	-	-	1	-	-	32.00	-	-	-	-	1	-	-	
Boston foreman and sub-foreman service,	2	-	-	66	1	-	55	1	5	-	5	34.33	50.00	-	-	-	56	-	11	
Boston sub-foreman promotion,	-	-	1	1	-	-	1	-	1	-	-	34.00	-	-	-	-	1	-	-	
Boston inspection service,	3	-	-	77	3	-	41	1	27	2	9	35.97	51.00	34.40	56.00	-	42	-	28	
Boston plumbing inspection service,	-	-	1	1	-	-	1	-	1	-	-	30.00	-	-	-	-	1	-	-	
Boston school janitor service,	1	-	-	29	-	1	10	-	3	-	5	43.00	-	43.05	-	48.00	10	-	30	
Boston truant officer service,	1	-	-	24	-	-	12	-	-	-	-	38.06	-	37.75	-	-	12	-	12	
	22	-	40	268	7	149	509	2	272	2	39	33.33	50.50	23.81	26.73	54.17	573	5	534	
	52			1,117			590			277		30		26.26		40.55		560		537

* This examination was held at the request of the Governor, to fill the position of inspector of bellows, and was confined to veterans of the war of the rebellion.

APPENDIX.

[illegible]

MASSACHUSETTS CIVIL SERVICE.

POLICE SERVICE, CITIES OTHER THAN BOSTON, AND TOWNS, UNDER CHAPTER 267, ACTS OF 1894.

	NUMBER OF EXAMINATIONS.		NUMBER EXAMINED.		NUMBER APPOINTED FROM THOSE EXAMINED.		Number of Unexamined Veterans appointed.	AVERAGE AGE OF THOSE PASSED.		AVERAGE AGE OF THOSE FAILED.		EDUCATION OF THOSE PASSED.		EDUCATION OF THOSE FAILED.	
	General Com-petitive.	Non-compet-itive.	Male Civilians.	Veterans.	Male Civilians.	Veterans.		Male Civilians.	Veterans.	Male Civilians.	Veterans.	Common School.	College.	Common School.	College.
Beverly,	1	-	12	-	9	-	4	28.11	-	31.00	-	9	-	8	-
Brockton,	1	-	23	-	18	-	4	30.72	-	33.40	-	18	-	5	-
Brookline,	1	-	13	-	9	-	-	26.67	-	32.50	-	9	-	4	-
Brookline, promotion,	-	6	6	-	6	-	-	38.33	-	-	-	6	-	-	-
Cambridge,	1	-	40	-	29	-	-	28.38	-	30.18	-	29	-	11	-
Chelsea,	1	-	7	-	7	-	2	31.71	-	-	-	7	-	-	-
Chelsea, promotion,	-	1	1	-	1	-	-	40.00	-	-	-	1	-	-	-
Chicopee,	1	-	10	-	6	-	-	30.83	-	31.00	-	6	-	4	-
Everett,	1	-	8	-	5	-	-	30.40	-	29.00	-	5	-	3	-
Fall River,	1	-	39	-	28	-	-	30.72	-	30.18	-	28	-	11	-
Fitchburg, promotion,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gloucester,	1	-	7	-	5	-	-	29.80	-	31.00	-	5	-	2	-
Haverhill,	1	-	9	-	6	-	1	28.50	-	25.33	-	6	-	3	-
Haverhill, promotion,	-	1	1	-	1	-	1	40.00	-	-	-	1	-	-	-
Holyoke,	1	-	14	-	10	-	-	30.20	-	30.00	-	10	-	4	-
Holyoke, promotion,	-	1	1	-	1	-	-	42.00	-	-	-	1	-	-	-
Lawrence,	1	-	24	-	11	-	3	29.73	-	32.38	-	11	-	18	-
Lowell,	1	-	53	-	41	-	-	31.00	-	29.76	-	41	-	17	-

APPENDIX.

[illegible]

MASSACHUSETTS CIVIL SERVICE.

SUMMARY.

	NUMBER OF EXAMINATIONS.			NUMBER EXAMINED.			NUMBER PASSED.			NUMBER APPOINTED FROM THOSE EXAMINED.			AVERAGE AGE OF THOSE PASSED.			AVERAGE AGE OF THOSE FAILED.			EDUCATION OF THOSE PASSED.		EDUCATION OF THOSE FAILED.			
	General Competitive.	Special Competitive.	Non-competitive.	Male Civilians.	Veterans.	Females.	Male (Williams).	Veterans.	Females.	Male Civilians.	Veterans.	Females.	Male (Williams).	Veterans.	Females.	Common School.	College.	Common School.	College.					
State clerical service.	6	-	1	168	4	973	60	3	238	1	-	57	6	24.48	55.00	25.11	27.46	56.50	24.60	287	13	281	5	
State clerical promotion.	-	-	2	-	-	2	-	-	2	-	-	1	-	-	-	-	32.00	-	-	-	2.	-	-	1
Boston clerical service.	4	-	-	177	2	131	48	-	68	5	-	1	8	23.75	-	22.94	28.09	53.50	23.74	105	6	198	2	
Boston clerical promotion.	-	-	1	1	-	-	1	-	-	1	-	-	-	24.00	-	-	-	-	-	-	1	-	-	1
Other cities, clerical service.	21	2	4	85	2	214	46	3	171	17	5	39	8	33.95	51.00	23.38	34.88	50.00	24.13	212	6	89	4	
Other cities, clerical promotion.	-	-	4	4	-	-	4	-	-	5	-	-	-	34.50	-	-	-	-	-	-	4	-	-	-
State fire service.	2	-	3	5	-	38	4	-	26	2	-	20	-	24.50	-	26.12	25.00	-	35.30	30	-	-	3	-
State fire promotion.	2	-	-	4	-	10	4	-	6	4	-	2	-	24.00	-	24.67	-	-	20.50	10	-	-	4	-
State fire promotion, type and ice.	1	-	-	-	-	9	-	-	-	-	-	2	-	-	-	21.53	-	-	19.67	6	-	-	3	-
State prison service.	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Boston prison service.	1	-	-	34	2	-	31	3	-	-	-	-	8	36.85	49.00	-	34.00	-	-	38	-	-	3	-
Boston fire service.	8	-	-	245	-	-	182	-	-	57	-	-	-	24.00	-	-	43.75	51.00	-	10	-	-	128	-
Boston fire promotion.	-	-	32	83	-	-	27	-	-	26	-	-	-	35.60	-	-	49.00	-	-	27	-	-	5	-

APPENDIX.

District police service, . . .	-	1	-	-	6	-	4	-	2	-	55.25	-	-	51.50	-	4	-	2	-
Boston police service, . . .	3	-	-	267	-	-	141	-	-	123	-	-	27.68	-	-	189	2	126	-
Boston police promotion, . . .	-	-	4	4	-	-	4	-	-	10	-	-	40.00	-	-	4	-	-	-
Other cities, police service, . .	29	-	-	588	-	-	394	-	42	163	-	-	29.66	-	-	394	-	194	-
Other cities, police promotion, .	-	-	18	18	-	-	17	-	4	18	-	-	40.48	-	-	17	-	1	-
Boston draw-tender and assistant draw-tender service, .	1	-	-	25	-	-	21	-	3	2	-	-	35.62	-	-	21	-	4	-
Boston assistant draw-tender promotion, .	-	-	1	1	-	-	1	-	-	1	-	-	32.00	-	-	1	-	-	-
Other cities, draw-tender service, .	1	-	-	5	-	-	3	-	1	-	-	-	39.33	-	-	3	-	3	-
Boston foreman and sub-foreman service, .	3	-	-	66	1	-	65	1	5	5	50.00	-	34.33	-	-	56	-	11	-
Boston sub-foreman promotion, .	-	-	1	1	-	-	1	-	-	1	-	-	34.00	-	-	1	-	-	-
Other cities, foreman service, .	9	-	1	52	1	-	38	1	3	23	51.00	-	36.52	-	-	39	-	14	-
Boston inspection service, . .	3	-	-	77	3	-	41	1	9	27	51.00	-	35.97	56.00	-	42	-	38	-
Other cities, inspection service, .	2	-	-	5	-	-	5	-	1	4	-	-	37.34	-	-	5	-	-	-
Boston plumbing inspection service, .	-	-	1	1	-	-	1	-	-	1	-	-	30.00	-	-	1	-	-	-
Other cities and towns, plumbing inspection service, .	-	-	8	8	-	-	5	-	-	5	-	-	40.13	-	-	5	-	3	-
Boston school janitor service, .	1	-	-	29	-	1	10	-	5	3	-	-	43.00	-	48.00	10	-	20	-
Other cities, fire service, . .	2	-	-	41	-	-	31	-	-	4	-	-	27.18	-	-	31	-	10	-
Boston truant officer service, .	1	-	-	24	-	-	12	-	-	-	-	-	38.08	-	-	12	-	12	-
Other cities, school janitor service, .	3	-	-	23	6	-	6	-	1	2	-	-	35.34	55.00	-	6	-	23	-
	99	3	81	1,999	32	773	1,153	12	512	516	9	122	116	33.03	51.66	25.08	26.56	1,117	10
		183		2,804			1,677			647			116	36.59			89.26	1,677	1,127

NON-COMPETITIVE EXAMINATIONS.

During the year there have been held 18 non-competitive examinations for original appointments, as follows : —

One store-keeper for service at the Medfield Insane Asylum, there being no person on the eligible list possessing the special qualifications required.

Four clerks for service in cities other than Boston, there being no eligible lists and no applicants.

Two stenographers and type-writers for service in State institutions, there being no persons on the eligible list willing to accept the positions.

One stenographer and type-writer for service in a State department, there being no person on the eligible list possessing the required qualifications.

One foreman for service in North Adams, there being no eligible list and no applicants.

Nine plumbing inspectors for appointment in cities and towns in the Commonwealth, under the requirements of section 5 of chapter 455, Acts of 1894, — one for service in Boston, one for service in Danvers and seven for service in cities other than Boston. In these cases competitive examinations were not held, for the reason that, under said section, the boards of health or inspectors of buildings in cities and towns are directed to make the appointments, and the law requires only that the persons so appointed shall pass a civil service examination.

Respectfully submitted,

WARREN P. DUDLEY,
Secretary.

HENRY SHERWIN,
Chief Examiner.

LABOR SERVICE IN BOSTON.

During the year ending Sept. 30, 1896, 108 requisitions for laborers and mechanics have been received from the various departments of the city of Boston. In response to these requisitions, 2,365 certifications were made, from which 964 persons were employed. Of the whole number of certifications, 1,518 were made in response to calls from the Transit Commission, where the work was deemed so arduous by the applicants that only 638 of them accepted it, and many of these for but a short time only.

Sixteen of the requisitions, upon which were certified 411 names, were cancelled, the appointing powers failing to make any selection therefrom; among these names were those of 397 veterans of the war of the rebellion and 14 others without such credit.

Whole number of applications received,	8,230
Number of names restored from previous years,	1,836
Applicants registered during year ending Sept. 30, 1896,	1,394
	<hr/>
Whole number of persons registered,	3,230
Number registered with credit as veterans,	839
Number registered without credit as veterans,	2,891
	<hr/>
	3,230
Percentage of those registered having credit as veterans,	10.50
Percentage of those registered not having credit as veterans,	89.50
Number of persons certified once,	1,563 = 1,563
Number of persons certified twice,	200 = 400
Number of persons certified three times,	69 = 207
Number of persons certified four times,	45 = 180
Number of persons certified five times,	8 = 15
	<hr/>
Whole number of persons certified,	1,880
Whole number of certifications,	2,365
Of whole number of certifications, there were of veterans,	442, or 18.69 per cent.
Of whole number of certifications, there were of others, not veterans,	1,923, or 81.31 per cent.
Number of persons employed, veterans,	35
Number of persons employed, not veterans,	929
	<hr/>
	964
Percentage employed of veterans registered,	10.32
Percentage employed of others (not veterans) registered,	32.13
Percentage employed of whole number registered,	29.84
Percentage employed of veterans certified,	7.92
Percentage employed of others (not veterans) certified,	48.31
Percentage employed of whole number certified,	40.76

DISCHARGES.

DEPARTMENTS.	By Order of Civil Service Commis- sion.	Lack of Work.	Resigned and withdrew.	Bad Habits.	Incom- petent and Unsat- isfactory.	Died.	Failed to report.	Transferred to Other De- partments.	Allenage.	No Cause assigned.	Total.
Street,	4	3	14	4	37	73	14	15	-	-	164
Water,	-	-	23	5	7	12	5	20	-	-	72
Public grounds,	-	-	4	-	-	-	-	16	-	-	20
Lamp,	-	-	2	-	-	6	-	1	-	-	9
Mt. Hope Cemetery,	-	2	1	-	-	-	-	1	-	-	4
Fire,	-	-	-	-	-	-	-	-	1	1	2
Park,	-	1	4	-	-	4	-	14	-	-	23
Transit Commission,	-	-	30	5	-	3	-	8	-	-	46
Improved sewerage,	-	-	-	-	-	-	-	7	-	-	7
Health,	-	-	-	-	-	-	-	1	-	-	1
	4	6	78	14	44	98	19	83	1	1	848

With each succeeding year the number of persons registered with special qualifications as skilled laborers and mechanics increases, and at the present time over 40 per cent. of the whole number of applicants for labor registered in this division have filed certificates of ability for some special service, other than that of common labor.

For this class of work there has been a comparatively small demand, and consequently many of those so registered have not been certified, while of those registered for common labor, with very few exceptions, all have been certified one or more times.

The several registration clerks in the cities outside of Boston, in which the labor service rules apply, have filed reports of the work in their respective cities, which are hereto annexed.

Respectfully submitted,

WILLIAM L. HICKS,

Registrar of Labor.

LABOR SERVICE IN CAMBRIDGE.

TO WILLIAM L. HICKS, *Registrar of Labor, Civil Service Commission,
State House, Boston, Mass.*

SIR :— I herewith submit a full and complete report of the business of my office for the year ending Sept. 30, 1896.

During the year ending Sept. 30, 1896, 39 requisitions for mechanics and laborers were received from the several departments of the city of Cambridge.

By an ordinance approved July 15, 1896, the ambulance was transferred to the police department.

There were 869 certifications made, and all requisitions were free from any limit as to age.

The table of discharges accompanying this report shows that less than one and one-half per cent. of men employed were discharged for bad habits.

A detailed statement follows :—

Whole number of applications received,	854	
Number of names restored from register of 1890,	1	
Number of names restored from register of 1891,	3	
Number of names restored from register of 1892,	6	
Number of names restored from register of 1893,	8	
Number of names restored from register of 1894,	16	
Number of names restored from register of 1895,	341	
Applicants registered during 1896,	479	
	<hr/>	854
Number registered with credit as veterans,	38	
Number registered without credit as veterans,	816	
	<hr/>	854
Percentage of those registered having credit as veterans,		4.45
Percentage of those registered not having credit as veterans,		95.55
Number of persons certified once,	496	496
Number of persons certified twice,	119	238
Number of persons certified three times,	29	87
Number of persons certified four times,	7	28
Number of persons certified five times,	4	20
	<hr/>	
Whole number of persons certified,	655	<hr/>
Whole number of certifications,		869

40 MASSACHUSETTS CIVIL SERVICE.

Number of registered veterans certified,	31	
Number of registered veterans not certified,	7	
	<hr/>	38
Number of persons not veterans certified,	624	
Number of persons not veterans not certified,	192	
	816	
	<hr/>	854
Of whole number of certifications there were of veterans,		
32, or	3.68 per cent.	
Of whole number of certifications there were of others,		
837, or	96.32 per cent.	
Number of persons employed, veterans,	26	
Number of persons employed, not veterans,	485	
	<hr/>	511
Percentage employed of veterans certified,	81.25	
Percentage employed of others (not veterans) certified,	57.94	
Percentage employed of veterans registered,	68.42	
Percentage employed of others (not veterans) registered,	59.43	
Percentage employed of whole number certified,	58.80	

RECAPITULATION.

DEPARTMENTS.	Regulations.	Number of Men called for.	NUMBER OF MEN CERTIFIED.		Total Number certified.	NUMBER OF MEN EMPLOYED.		Total Number employed.	Restored and transferred by Commissioners.	Number on Roll Oct. 1, 1898.	Whole Number on Department Rolls to Oct. 1, 1898.	Number dropped from the Rolls.	Number at Present on the Rolls.
			Veterans.	Others.		Veterans.	Others.						
Almshouse,	1	1	-	1	1	-	1	1	-	49	50	1	49
Cemetery,	2	6	-	12	12	-	7	7	-	27	34	7	27
Health,	-	-	-	-	-	-	-	-	-	1	1	-	1
Lamp,	-	-	-	-	-	-	-	-	-	7	7	-	7
Park,	5	35	11	59	70	8	21	29	-	58	87	17	70
Police (drivers, patrol),	-	-	-	-	-	-	-	-	-	4	4	-	4
Police (drivers, ambulance),	-	-	-	-	-	-	-	-	-	3	3	-	3
Sewers,	5	107	5	209	214	4	83	87	-	67	154	48	106
Street,	4	29	5	52	57	5	27	32	-	233	265	46	219
Water works,	22	260	11	504	515	9	346	355	-	322	677	408	269
	39	438	32	837	869	26	485	511	-	771	1,282	527	755

DISCHARGES.

DEPARTMENTS.	Lack of Work.	Resigned and withdrew.	Bad Habits.	Incompetent and Unsatisfactory.	Died.	Failed to report and declined.	Transferred to Other Depart- ments.	Total Number discharged.
Almshouse, . . .	-	-	1	-	-	-	-	1
Cemetery, . . .	1	6	-	-	-	-	-	7
Health,	-	-	-	-	-	-	-	-
Lamp,	-	-	-	-	-	-	-	-
Park,	-	10	3	1	1	2	-	17
Police (drivers, pa- trol),	-	-	-	-	-	-	-	-
Police (drivers, am- bulance),	-	-	-	-	-	-	-	-
Sewers,	27	17	1	-	-	3	-	48
Street,	-	15	4	4	1	22	-	46
Water works, . .	230	63	6	20	5	84	-	408
	258	111	15	25	7	111	-	527

Respectfully submitted,

HARRY L. LINCOLN,

Registration Clerk.

LABOR SERVICE IN NEWTON.

To WILLIAM L. HICKS, *Registrar of Labor, Civil Service Commission,*
State House, Boston, Mass.

SIR : — I herewith submit a full and complete report of the business of my office for the year ending Sept. 30, 1896.

During the year ending Sept. 30, 1896, 14 requisitions for mechanics and laborers were received from the several departments of the city of Newton. There were 447 certifications made in response to requisitions which specified a limit of age at fifty years.

Of the total number of laborers and mechanics employed during the year, about 35.11 per cent. were for special service in the highway department for widening Washington Street, grade crossings and deepening of brooks; in the sewer department, for lowering sewers; and in the water department, for lowering and changing water pipe.

A table of discharges accompanying this report shows that only nine one-hundredths of one per cent. of men employed were discharged for bad habits.

Number of applications received,	471
Number registered with credit as veterans,	6
Number registered without credit as veterans,	465
	<hr/> 471
Percentage of those registered having credit as veterans,	1.27
Percentage of those registered not having credit as veterans,	98.73
Number of persons certified once,	431 = 431
Number of persons certified twice,	8 = 16
	<hr/>
Whole number of persons certified,	439
Whole number of certifications,	447
Number of registered veterans certified,	2
Number of registered veterans not certified,	4
	<hr/> 6
Number of persons registered (not veterans) certified,	431
Number of persons registered (not veterans) not certified,	34
	<hr/> 465
	<hr/> 471

44 MASSACHUSETTS CIVIL SERVICE.

Of the whole number of certifications there were,	
of veterans,	2, or 45 per cent.
Of the whole number of certifications there were,	
of others,	445, or 99.55 per cent.
Number of persons employed, veterans,	1
Number of persons employed, not veterans,	352
<hr/>	
Total number employed,	353
Percentage employed of veterans certified,	50.00
Percentage employed of others (not veterans) certified,	79.10
Percentage employed of veterans registered,	16.66
Percentage employed of others (not veterans) registered,	75.70

RECAPITULATION.

DEPARTMENTS.	Regulations.	Number of Men called for.	NUMBER OF MEN CERTIFIED.		Total Number certified.	NUMBER OF MEN EMPLOYED.		Total Number employed.	Restored and transferred by Commissioners.	Number on Roll Oct. 1, 1895.	Whole Number on Department Rolls to Oct. 1, 1896.	Number dropped from the Rolls.	Number at present on the Rolls.
			Veterans	Others.		Veterans.	Others.						
Highway,	7	155	1	251	252	1	212	213	5	408	626	137	489
Sewer,	4	95	1	135	136	-	108	108	3	184	295	113	182
Water,	3	54	-	59	59	-	32	32	2	100	134	62	72
Health,	-	-	-	-	-	-	-	-	-	1	1	-	1
Police patrol,	-	-	-	-	-	-	-	-	-	1	1	-	1
	14	304	2	445	447	1	352	353	10	694	1,057	312	745

DISCHARGES.

DEPARTMENTS.	Lack of Work.	Resigned and withdrew.	Bad Habits.	Incompetent and Unsatisfactory.	Died.	Failed to report and declined.	Transferred to Other Departments.	Total Number discharged.
Highway, . . .	10	87	7	13	-	18	2	137
Sewer, . . .	25	45	-	3	-	37	3	113
Water, . . .	25	25	3	3	1	-	5	62
	60	157	10	19	1	55	10	312

Respectfully submitted,

THEODORE A. FLEU,

Registration Clerk.

LABOR SERVICE IN NEW BEDFORD.

TO WILLIAM L. HICKS, *Registrar of Labor, Civil Service Commission,*
State House, Boston, Mass.

SIR : — I herewith submit a full and complete report of the business of my office for the year ending Sept. 30, 1896.

During the year 341 new names have been added to the register, which, together with those restored from previous years, have proved amply adequate for the needs of the labor service in this city. Requisitions have been received from the several departments for 169 persons, and in response thereto the names of 289 persons have been certified; among the names certified were those of 13 veterans and 276 others who were not so credited.

Of the 13 veterans certified, all were employed. Of the 276 others, 156, or 56.52 per cent., were employed. Of the whole number certified, 169, or 58.47 per cent., were employed.

There were 113 discharges from the various departments during the year, 27 of which were because of a lack of work and 86 because of resignations and withdrawals from the work.

Respectfully submitted,

RUFUS H. WILLIS,

Registration Clerk.

LABOR SERVICE IN EVERETT.

TO WILLIAM L. HICKS, *Registrar of Labor, Civil Service Commission,
State House, Boston, Mass.*

SIR : — I herewith submit a full and complete report of the business of my office for the year ending Sept. 30, 1896.

On Jan. 1, 1896, the civil service rules were made applicable to the labor service of the city of Everett, and during the nine months in which they have been in force there have been registered for employment 122 persons, of whom 7 were veterans and 115 others were without such credit.

Of those registered, 83 persons, or 68 per cent of the total registration, were certified and employed in the various departments, 4 of whom were veterans.

During the same time the discharges have been as follows : —

For bad habits,	.	.	.	.	.	.	.	.	3
For unsatisfactory service,	.	.	.	.	.	.	.	.	8
For failing to report and declining work,	.	.	.	.	.	.	.	.	17
Resigned,	.	.	.	.	.	.	.	.	10
Total,	.	.	.	.	.	.	.	.	<u>38</u>

Respectfully submitted,

CHARLES J. MORGAN,
Registration Clerk.

Commonwealth of Massachusetts.

[Chapter 820, Acts of 1884.]

AN ACT TO IMPROVE THE CIVIL SERVICE OF THE COMMONWEALTH
AND THE CITIES THEREOF.*Be it enacted, etc., as follows :*

SECTION 1. The governor shall with the advice and consent of the council appoint three persons to be civil service commissioners, who shall serve, one until the expiration of three years, one until the expiration of two years, and one until the expiration of one year, from the first day of July in the year eighteen hundred and eighty-four, and until their respective successors are appointed and qualified ; and in the year eighteen hundred and eighty-five and in every year thereafter, the governor shall, in May or June, in like manner, appoint one person to serve as such commissioner for three years from the first Monday in the July then next ensuing, and until his successor is appointed and qualified. Any vacancy in the office of commissioner shall be filled for the unexpired term by appointment as above provided. All appointments, both original and to fill vacancies, shall be so made that not more than two commissioners shall, at the time of any appointment, be members of the same political party. The governor may also, with the advice and consent of the council, remove any commissioner. Each commissioner shall be paid five dollars for each day's service, and his traveling and other necessary expenses in the discharge of his official duty.

Civil service
commissioners
to be appointed.Not more than
two commis-
sioners to be of
same political
party.

SECT. 2. The said commissioners shall prepare rules not inconsistent with existing laws or with the provisions of this act, and adapted to carry out the purposes thereof, for the selection of persons to fill offices in the government of the Common-

Commissioners
to prepare
rules.

Rules subject to approval of governor and council.

Annual report to the general court.

Amended, c. 393, § 5, Acts of 1894.

Vender of liquor or person using same to excess.

Person convicted of offence.

As amended by c. 334, Acts of 1888.

Recommendations.

Officials not to solicit contributions for political purposes.

wealth and of the several cities thereof, which are required to be filled by appointment, and for the selection of persons to be employed as laborers or otherwise in the service of the Commonwealth and of the several cities thereof. All rules so prepared shall be subject to the approval of the governor and council, and they may, with like approval, be from time to time altered or rescinded. The said commissioners shall supervise the administration of the rules so established; they shall from time to time suggest to the general court such legislation as may seem to them to be desirable for the efficient carrying out of the principles of this act, and for the improvement of the civil service; and they shall, on or before the tenth day of January in every year, report to the general court their doings during the preceding year, including any rules adopted under the provisions of this section.

SECT. 3. No person habitually using intoxicating beverages to excess shall be appointed to, or retained in any office, appointment or employment to which the provisions of this act are applicable; nor shall any vender of intoxicating liquor be so appointed or retained.

SECT. 4. No person shall be appointed to or employed in any office to which the provisions of this act are applicable within one year after his conviction of any offence against the laws of this Commonwealth.

SECT. 5. No recommendation of any person who shall apply for office or place under the provisions of this act, which may be given by any senator, member of the house of representatives, alderman or councilman, except as to the character or residence of the applicant, shall be received or considered by any person concerned in making any appointment under this act.

SECT. 6. No councillor, senator, representative, alderman or councilman, or any officer or employee of either of said bodies, and no executive or judicial officer of the state, and no clerk or employee of any department or branch of the government of the state, and no executive officer, clerk or employee of any department of any city government shall personally, directly or indirectly, solicit or receive, or be in any manner concerned in soliciting or receiving, any assessment, subscription or contribution for any political purpose whatever; but this shall not be construed to forbid such persons to be members of political organizations or committees.

SECT. 7. No person shall, in any room or building occupied for the discharge of official duties by any officer or employee of the state or any city thereof, solicit in any manner whatever, or receive, any contribution of money or any other thing of value for any political purpose whatever.

Solicitations not to be made in buildings used for official duties.

SECT. 8. No officer or employee of the state, or any city thereof, shall discharge, or promote, or degrade, or in any manner change the official rank or compensation of any other officer or employee, or promise or threaten to do so, for giving or withholding or neglecting to make any contribution of money or other valuable thing for any political purpose.

Officers not to be affected by refusal to contribute.

SECT. 9. No officer, clerk or other person in the service of the state or any city thereof shall, directly or indirectly, give or hand over to any other officer, clerk or person in said service, or to any councillor, senator, member of the house of representatives, alderman, councilman, or commissioner, any money or other valuable thing on account of or to be applied to the promotion of any political object whatever.

No officer to give money to another officer for political object.

SECT. 10. No person in the service of the state or any city thereof shall use his official authority or influence either to coerce the political action of any person or body or to interfere with any election.

Political action not to be coerced.

SECT. 11. No person in the public service shall for that reason be under any obligation to contribute to any political fund or to render any political service, and shall not be removed or otherwise prejudiced for refusing to do so.

Public officers not obliged to contribute to political fund.

SECT. 12. No person while holding any public office or in nomination for, or while seeking a nomination or appointment for any office, shall corruptly use, or promise to use, either directly or indirectly, any official authority or influence (whether then possessed or merely anticipated), in the way of conferring upon any person, or in order to secure or aid any person in securing any office or public employment, or any nomination, confirmation, promotion or increase of salary, upon the consideration or condition that the vote or political influence or action of the last named person, or any other, shall be given or used in behalf of any candidate, officer or party, or upon any other corrupt condition or consideration.

Corrupt methods of procuring nominations, etc.

SECT. 13. No city in the Commonwealth shall pay any bill incurred by any official or officials thereof for wines, liquors or cigars; nor shall any city pay any bill for refreshments fur-

Wines, etc., furnished city officials not to be paid for by city.

nished to any official of said city where the amount for any one day shall exceed one dollar for each member of the government of said city who certifies over his own signature to the correctness of the bill.

General rules.

SECT. 14. The rules mentioned in section two may be made from time to time, and may be given a general or a limited application, and they shall, among other things, provide:—

First, For the classification of the offices and employments to be filled.

Second, For open competitive and other examinations by which to test applicants for office, or for employment, as to their practical fitness to discharge the duties of the positions which they desire to fill.

Third, For the filling of vacancies in offices in accordance with the results of such examinations and for the selection of persons for public employment in accordance with such results, or by order of application, or otherwise, as may seem most desirable to carry out the provisions of this act.

Fourth, For promotions in office on the basis of ascertained merit and seniority in service and examination as may seem desirable. (In all cases where it is practicable vacancies shall be filled by promotion.)

Fifth, For a period of probation before an appointment or employment is made permanent.

Amended, c. 473,
Acts of 1889,
and c. 517,
Acts of 1896.
See page 62.

Sixth, For giving preference in appointments to office and promotions in office to applicants who served in the army or navy of the United States in time of war and have been honorably discharged therefrom.

Officers not af-
fected.

As amended by
c. 95, Acts of
1893, and c. 502,
Acts of 1896.

SECT. 15. Judicial officers and officers who are elected by the people, or a city council, or whose appointment is subject to confirmation by the executive council of the Commonwealth, or the city council of any city, officers who are elected by either branch of the general court and the appointees of such officers, heads of any principal departments of the Commonwealth or of a city, the employees of the treasurer of the Commonwealth, the employees of the board of commissioners of savings banks, and of the treasurer and collector of taxes of any city, two employees of the city clerk of any city, teachers of the public schools, the secretaries and confidential stenographers of the governor or of the mayor of any city, shall not be affected as to their selection or appointment by any rules made as aforesaid, but such rules shall apply to members of the police and

fire departments, other than police and fire commissioners and chief marshals, or chiefs of police and fire departments.

SECT. 16. No question in any examination under the rules established as aforesaid shall relate to political or religious opinions or affiliations, and no appointment or selection to an office or for employment within the scope of the rules established as aforesaid shall be in any manner affected or influenced by such opinions or affiliations. Such examinations shall be practical in their character, and so far as may be shall relate to those matters which will fairly test the relative capacity and fitness of the persons examined to discharge the duties of the service into which they seek to be appointed. The examination of applicants for employment as laborers shall relate to their capacity for labor, their habits as to industry and sobriety, and the necessities of themselves and their families.

No examination concerning political or religious opinions.

Examinations to be practical.

SECT. 17. Every application, in order to entitle the applicant to appear for examination or to be examined, must state the facts under oath on the following subjects: 1. Full name, residence and post-office address. 2. Citizenship. 3. Age. 4. Place of birth. 5. Health and physical capacity for the public service. 6. Right of preference by reason of military or naval service. 7. Previous employment in the public service. 8. Business or employment and residence for the previous five years. 9. Education. Such other information shall be furnished as may reasonably be required touching the applicant's fitness for the public service.

Statements to be made by applicants for examination.
As amended by c. 183, Acts of 1889.

SECT. 18. No person in the public service shall wilfully and corruptly, by himself or in coöperation with one or more other persons, defeat, deceive, or obstruct any person in respect of his or her right of examination; or wilfully, corruptly or falsely mark, grade, estimate or report upon the examination or proper standing of any person examined hereunder, or aid in so doing; or wilfully or corruptly make any false representations concerning the same or concerning the person examined; or wilfully or corruptly furnish to any person any special or secret information, for the purpose of either improving or injuring the prospects or chances of any person so examined, or to be examined, being appointed, employed or promoted.

Persons in public service not to obstruct any one in respect of right of examination, nor to furnish secret information.

SECT. 19. All rules established as hereinbefore provided, and all changes therein, shall forthwith be printed for distribution by said commissioners, and a certified copy thereof shall be sent to the mayor of each city to which such rules or changes therein re-

Rules to be printed and distributed.
As amended by c. 253, Acts of 1888.

late, and the same shall be published in one or more newspapers, and in any such publication of rules shall be specified the date, not less than sixty days subsequent to the date of such publication, when such rules shall go into operation, and thereafter all appointments to office and selections for employment shall be made according to said rules in cases to which said rules apply.

Chief examiner
to be appointed.

As amended by
c. 177 and 351,
Acts of 1889.

SECT. 20. The said commissioners may appoint a chief examiner, who shall, under their direction, superintend any examination under this act, and shall perform such other duties as they may prescribe. Such chief examiner shall receive a salary of three thousand dollars a year, and shall be paid his necessary travelling expenses incurred in the discharge of his official duty. They may also employ a secretary, at a salary of two thousand dollars a year. They may designate persons in the official service of the Commonwealth, or of any city, who shall, with the consent of the head of department or office in which any such person serves, act in any examination held under this act. But no person shall serve as examiner of candidates for office, under the provisions of this act, when any relative or connection by marriage, within the degree of first cousin, shall be an applicant. The said commissioners may also incur such expense, not exceeding fifteen hundred dollars a year, as may be proper for printing and stationery and other incidental matters.

Secretary.

Expenses of
commissioners.

C. 2, Resolves
1885.
C. 34, Resolves
1892.

SECT. 21. The said commissioners shall be provided, under the direction of the governor and council, with an office, properly furnished, in the state house or Commonwealth building, suitable for the performance of the duties imposed by this act.

Name and
residence of
every person
appointed, etc.,
to be reported to
commissioners.

SECT. 22. The name and residence of every person appointed, employed or promoted to or in any position coming within the rules established as herein provided, except laborers, together with the name or description of such position and the subsequent rejection or discharge of every such person, shall forthwith be reported to the said commissioners by the officer making such appointment, promotion, rejection or discharge, or providing such employment.

Commissioners
to keep records.

SECT. 23. The said commissioners shall keep records of all their proceedings and of all examinations made by them or under their authority, and all recommendations of applicants for office received by said commissioners or either of them, or by any officer having authority to make appointments to office or to employ laborers, or others coming within the scope of the

rules established as aforesaid, shall be kept and preserved, and all such records and recommendations shall, subject to such reasonable regulations as may be approved by the governor and council, be open to public inspection.

SECT. 24. Whoever, after a rule has been duly established and published according to the provisions of this act, makes an appointment to office or selects a person for employment contrary to the provisions of such rule, or wilfully refuses or neglects otherwise to comply with or to conform to the provisions of this act, or violates any of such provisions, shall be liable to a penalty of not less than one hundred nor more than one thousand dollars for each offence. [*Approved June 3, 1884.*]

Penalty.

[Chapter 352, Acts of 1889.]

AN ACT PLACING ENGINEERS AND OTHERS HAVING CHARGE OF STEAM BOILERS IN SCHOOL BUILDINGS IN THE CITY OF BOSTON UNDER CIVIL SERVICE RULES.

Be it enacted, etc., as follows :

SECTION 1. Engineers, janitors and all persons having charge of steam boilers and furnaces in the school buildings in the city of Boston shall be classified and appointed pursuant to the provisions of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four, entitled, "An Act to improve the civil service of the Commonwealth and the cities thereof," and the rules of the civil service commissioners made and established thereunder.

Certain engineers and janitors in Boston placed under civil service rules.

SECT. 2. This act shall take effect upon its passage. [*Approved May 21, 1889.*]

[Chapter 140, Acts of 1891.]

AN ACT TO AUTHORIZE THE CIVIL SERVICE COMMISSIONERS TO SUMMON WITNESSES AND TAKE TESTIMONY.

Be it enacted, etc., as follows :

The civil service commissioners or any of them, in all cases requiring investigation by them, may summon witnesses in behalf of the Commonwealth, and may administer oaths and take testimony in such cases. The fees of such witnesses for attend-

The civil service commissioners may summon witnesses and take testimony.

ance and travel shall be the same as for witnesses before the superior court, and shall be paid from the appropriation for the incidental expenses of the commissioners. Any justice of the superior court, either in term time or vacation, upon application of the commissioners, may in his discretion compel the attendance of such witnesses and the giving of testimony before the commissioners in the same manner and to the same extent as before said court. [*Approved March 28, 1891.*]

[Chapter 95, Acts of 1893.]

AN ACT TO DEFINE EXEMPTIONS FROM THE CIVIL SERVICE RULES.

Be it enacted, etc., as follows:

Section fifteen of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four is hereby amended by striking out in the first line of said section, the words "elective or", by inserting after the words "and officers", in said first line, the words:—who are elected by the people or a city council or,— by striking out in the third line, the words "a city council or a school committee", and inserting in place thereof the words:—of the Commonwealth, or the city council of any city, officers who are elected by either branch of the general court and the appointees of such officers,— by striking out after the word "principal", in the fourth line, the words "department in", and inserting in place thereof the words:—departments of the Commonwealth or of,— by striking out in the fourth, fifth and sixth lines, the words "officers for the faithful discharge of whose duties a superior officer is required to give bonds", and inserting in place thereof the words:—the employees of the treasurer of the Commonwealth, and of the treasurer and collector of taxes of any city, two employees of the city clerk of any city,— by striking out in the seventh line, the words "private secretary", and inserting in place thereof the words:—secretaries and confidential stenographers,— by striking out in the eighth line, the words "election or", and inserting after the word "selection", in said line, the words:—or appointment,— by inserting after the word "commissioners", in the eleventh line, the word:—and,— by striking out in said eleventh line, the words "superin-

tendents and ", by striking out after the word " marshals ", in the twelfth line, the words " of police departments and chief engineers of ", and inserting in place thereof the words : — or chiefs of police and, — so as to read as follows : — *Section 15.*

Judicial officers and officers who are elected by the people, or a city council, or whose appointment is subject to confirmation by the executive council of the Commonwealth, or the city council of any city, officers who are elected by either branch of the general court and the appointees of such officers, heads of any principal departments of the Commonwealth or of a city, the employees of the treasurer of the Commonwealth, and of the treasurer and collector of taxes of any city, two employees of the city clerk of any city, teachers of the public schools, the secretaries and confidential stenographers of the governor or of the mayor of any city, shall not be affected as to their selection or appointment by any rules made as aforesaid, but such rules shall apply to members of the police and fire departments, other than police and fire commissioners and chief marshals, or chiefs of police and fire departments. [*Approved March 17, 1893.*]

Officers and employees exempted from civil service rules.

[Chapter 253, Acts of 1893.]

**AN ACT PLACING TRUANT OFFICERS IN THE CITY OF BOSTON
UNDER CIVIL SERVICE RULES.**

Be it enacted, etc., as follows :

SECTION 1. All truant officers hereafter appointed by the school committee of the city of Boston, as provided in section eleven of chapter forty-eight of the Public Statutes, shall be classified and appointed pursuant to the provisions of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four and the rules of the civil service commissioners made and established thereunder.

Appointment and classification of truant officers in Boston.

SECT. 2. This act shall take effect upon its passage. [*Approved April 24, 1893.*]

[Chapter 267, Acts of 1894.]

**AN ACT EXTENDING THE PROVISIONS OF THE CIVIL SERVICE
ACT TO TOWNS HAVING A POPULATION OF TWELVE THOUSAND
INHABITANTS OR OVER.**

Be it enacted, etc., as follows :

SECTION 1. The provisions of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-

Provisions of civil service act extended.

MASSACHUSETTS CIVIL SERVICE.

four entitled, "An act to improve the civil service of the Commonwealth and the cities thereof", and of all acts in amendment thereof and in addition thereto, are hereby extended and made applicable to all towns of the Commonwealth having a population of twelve thousand inhabitants or over.

SECT. 2. This act shall take effect in any such town upon its acceptance by a majority of the legal voters of said town present and voting thereon at a town meeting called for the purpose. [*Approved April 17, 1894.*]

[Chapter 376, Acts of 1895.]

AN ACT TO AUTHORIZE THE APPOINTMENT OF A REGISTRAR OF
LABOR.

Be it enacted, etc., as follows:

Civil service
commissioners
may appoint a
registrar of
labor.

SECTION 1. The civil service commissioners are authorized to appoint a registrar of labor, who shall under their direction supervise the administration of civil service rules applicable to the public labor service of the Commonwealth or any city thereof. He shall receive an annual salary of two thousand dollars and be allowed his actual travelling expenses incurred in the discharge of his official duties. The salary and travelling expenses for the current year shall be paid from the appropriation for clerical assistance and travelling expenses of the civil service commissioners as authorized by chapter thirteen of the acts of the present year.

SECT. 2. This act shall take effect upon its passage. [*Approved May 11, 1895.*]

[Chapter 256, Acts of 1896.]

AN ACT RELATIVE TO APPOINTMENTS IN THE BOSTON FIRE
DEPARTMENT.

Be it enacted, etc., as follows:

Appointments in
Boston fire de-
partment.

SECTION 1. All call members in the Boston fire department who have served three or more successive years in said service shall, upon application to the civil service commissioners, be placed upon the eligible list for appointment as permanent men, without any further examination. The fire commissioner may at his discretion appoint such men on the permanent force,

at the same salary as a permanent man who has served three or more years in said service.

SECT. 2. This act shall take effect upon its acceptance by the city government of the city of Boston. [*Approved April 9, 1896.*]

[Chapter 424, Acts of 1896.]

AN ACT RELATIVE TO THE QUALIFICATIONS OF FIREMEN.

Be it enacted, etc., as follows :

SECTION 1. Persons five feet five inches in height, and over, shall be eligible to appointment on the fire force of the city of Boston, if otherwise qualified; and no rules shall be made by the civil service commissioners in conflict with the provisions of this section. Qualifications of firemen in Boston.

SECT. 2. This act shall take effect upon its passage. [*Approved May 21, 1896.*]

[Chapter 449, Acts of 1896.]

AN ACT RELATIVE TO THE EMPLOYMENT OF LABORERS IN THE CITIES OF THE COMMONWEALTH.

Be it enacted, etc., as follows :

SECTION 1. So much of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four and the amendments thereto as relates to the employment of laborers by cities, and that portion of the civil service rules of the Commonwealth and the cities thereof as authorized by said acts and designated therein as the "Labor Service", shall not take effect in cities of less than one hundred thousand population, except upon acceptance by the city council of such city, with the approval of its mayor: *provided*, that the city council of such cities shall establish rules under which veterans of the late war of the rebellion shall be given the preference in employment. Employment of laborers in cities.

SECT. 2. This act shall take effect upon its passage. [*Approved May 28, 1896.*]

[Chapter 502, Acts of 1896.]

AN ACT RELATIVE TO THE CIVIL SERVICE OF THE COMMONWEALTH AND THE CITIES THEREOF.

Be it enacted, etc., as follows :

SECTION 1. Section fifteen of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty- 1884, § 15, etc., amended.

Officers and employees exempted from civil service rules.

four, as amended by chapter ninety-five of the acts of the year eighteen hundred and ninety-three, is hereby amended by inserting after the word "Commonwealth", in the ninth line, the words:—the employees of the board of commissioners of savings banks,—so that the section as amended will read as follows:—*Section 15.* Judicial officers and officers who are elected by the people, or a city council, or whose appointment is subject to confirmation by the executive council of the Commonwealth, or the city council of any city, officers who are elected by either branch of the general court and the appointees of such officers, heads of any principal departments of the Commonwealth or of a city, the employees of the treasurer of the Commonwealth, the employees of the board of commissioners of savings banks, and of the treasurer and collector of taxes of any city, two employees of the city clerk of any city, teachers of the public schools, the secretaries and confidential stenographers of the governor or of the mayor of any city, shall not be affected as to their selection or appointment by any rules made as aforesaid, but such rules shall apply to members of the police and fire departments, other than police and fire commissioners and chief marshals, or chiefs of police and fire departments.

SECT. 2. This act shall take effect upon its passage.
[Approved June 5, 1896.]

[Chapter 517, Acts of 1896.]

AN ACT RELATIVE TO THE PUBLIC SERVICE OF THE COMMONWEALTH AND THE CITIES AND TOWNS THEREOF, AND THE EMPLOYMENT OF VETERANS THEREIN.

Be it enacted, etc., as follows:

The word "veteran" defined.

SECTION 1. The word "veteran", in this act shall mean a person who served in the army or navy of the United States in the time of the war of the rebellion and was honorably discharged therefrom.

Veterans may apply for examination for positions in the public service.

SECT. 2. Veterans may apply for examination for any position in the public service classified under chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four and acts in amendment thereof, and the civil service rules thereunder, subject to said rules; and if such veterans pass the examination they shall be preferred in appoint-

ment to all persons not veterans; and it shall be the duty of the civil service commissioners to cause the names of veterans passing examination to be placed upon the eligible list for the position sought, in the order of the respective standing of such veterans, above the names of all applicants not veterans. The commissioners shall cause to be certified to the appointing officers for appointment the names of all such veterans in preference to applicants not veterans, so long as there are names of veterans upon the eligible list, and the appointment shall be made from the list so certified. But nothing herein contained shall be construed to prevent the certification and employment of women.

Commissioners to cause veterans to be certified in preference to applicants not veterans.

SECT. 3. Veterans may apply for appointment to or for employment in any position in the public service, classified as aforesaid, without examination. In such application such veteran shall state under oath such facts as may be required by the civil service rules. Age, loss of limb or other physical impairment, which shall not in fact incapacitate, shall not disqualify such veteran from appointment under this section. Appointing officers may by requisition call for the names of any or all such veterans so applying without examination, and appoint or employ any of them in the office or position sought.

Veterans may apply for appointment without examination.

SECT. 4. The civil service commissioners, within five days after the final markings upon any examination of applicants for positions in the public service, shall cause a list of the names of applicants passing the examination, to be prepared, showing the standing of each obtained in the examination; they shall also within five days after any certification of persons for appointments or employment, cause a list of the names of the persons so certified to be prepared, and said lists shall be open to public inspection during the office hours of the commissioners.

List of applicants passing examination to be prepared, etc.

SECT. 5. No veteran holding an office or employment in the public service of any city or town of the Commonwealth shall be removed or suspended, or shall without his consent be transferred from such office or employment, except after a full hearing before the mayor of such city or before the selectmen of such town, and at such hearing the veteran shall have the right to be present and to be represented by counsel. Such removal, suspension or transfer shall be made only upon the written order of the mayor or of the selectmen.

Veterans not to be removed without a hearing.

Commissioners
to establish
rules.

SECT. 6. The civil service commissioners shall establish rules to secure the employment of veterans in the labor service of the Commonwealth and of the cities and towns thereof, in the class for which they make application, in preference to all other persons, except women. The civil service commissioners may recognize an age limit in certifying persons for employment in the labor service, provided the appointing officer shall certify in his requisition that the work to be performed is so arduous as to require the services of young and vigorous men, and provided also that the commissioners shall upon investigation become satisfied that such certificate is true. In towns and cities in which the civil service act and the rules of the civil service commissioners have not been applied to the labor service the selectmen of the towns and the city councils of the cities shall take such action as may be necessary to secure the employment of veterans in the labor service of their respective towns and cities, in preference to all other persons, except women. Citizens of Massachusetts who have distinguished themselves by gallant and heroic conduct while serving in the army or navy of the United States, and who have received a medal of honor from the president of the United States, shall be deemed to be veterans under the meaning of this act and shall receive all the benefits thereof.

Certain persons
to be deemed
veterans.

Penalty.

SECT. 7. Whoever violates any provision of this act shall be punished by a fine of not less than one hundred nor more than one thousand dollars for each offence.

Repeal.

SECT. 8. Chapter four hundred and thirty-seven of the acts of the year eighteen hundred and eighty-seven, chapter four hundred and seventy-three of the acts of the year eighteen hundred and eighty-nine, chapter five hundred and nineteen of the acts of the year eighteen hundred and ninety-four, the words "other qualifications being equal", in the sixth clause of section fourteen of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four, and chapter five hundred and one of the acts of the year eighteen hundred and ninety-five, are hereby repealed.

SECT. 9. This act shall take effect upon its passage. [*Approved June 9, 1896.*]

Commonwealth of Massachusetts.

OPINION OF THE SUPREME JUDICIAL COURT IN THE CASE OF
BROWN v. CIVIL SERVICE COMMISSIONERS.

FIELD, C. J. In determining the principal question in this case, it is necessary to consider the statutes relating to the civil service, and particularly St. 1895, c. 501. The previous statutes on the subject are St. 1884, c. 320; St. 1887, c. 437; St. 1889, c. 352; St. 1889, c. 473; St. 1891, c. 140; St. 1893, c. 95; St. 1893, c. 253; St. 1894, c. 267; and St. 1895, c. 376. The justices of this court heretofore have had occasion to consider some of these statutes in an opinion given to the House of Representatives on Feb. 24, 1885, and in one given to the Governor and Council on Sept. 22, 1887. (See 138 Mass. 601; 145 Mass. 587.)

By St. 1884, c. 320, § 2, the Civil Service Commissioners to be appointed under the act were authorized to prepare rules not inconsistent with existing laws or with the provisions of the act and adapted to carry out the purposes thereof, for the selection of persons to fill certain offices in the government of the Commonwealth and of the several cities thereof which are required to be filled by appointment, and for the selection of persons to be employed as laborers or otherwise in the service of the Commonwealth and of the several cities thereof, and the rules were made subject to the approval of the Governor and Council; and by § 14 the rules were to be given a general or limited application. The commissioners have prepared rules with reference to what is called the official service of the Commonwealth and of the several cities thereof, and with reference to the labor service, and these rules have been approved by the Governor and Council. Under the classification of the services made by the rules there are included in the first division, schedule A, clerks and other persons rendering services as copyists, etc., and in schedule B, persons employed in the prison, police and fire departments and some other officers. The second division includes the labor service. Section 15 of

the St. of 1884, as amended by the St. of 1895, c. 95, describes the offices which, under existing laws, cannot be made subject to the civil service rules. It is obvious that the civil service statutes and rules relate only to certain subordinate offices and employments which have been created by the Legislature. None of them is an office or employment of which the duties, tenure or qualifications are prescribed by the Constitution.

In the present case the petitioner is not a veteran, and, after examination, was placed at the head of the list of candidates eligible for certification and appointment to a position on the detective force of the district police of the Commonwealth, and he remained at the head of the list until July, 1895, when the commissioners placed one Edward D. Bean at the head of the list and reduced the petitioner to the second place. Bean had made application as a veteran under St. 1895, c. 501, § 2, and, having been found to be a veteran, was, without examination, placed first upon the list; and, so far as appears, he is the only veteran on the list. The district police are appointed by the Governor of the Commonwealth, and are subject to removal by the Governor. (Pub. Sts., c. 103, § 1.) If the Governor makes requisition upon the commissioners for a candidate for appointment to the office of a detective upon this police force, it is made the duty of the commissioners, by the St. of 1895, to certify the name of Edward D. Bean for appointment, and of the Governor to appoint him, if he appoints anybody. The Governor perhaps may refuse to appoint anybody, if he is of opinion that Bean is not qualified to perform the duties of a detective on this force; or he may wait until more veterans than one are on the list of persons eligible to such an appointment, and make his selection from them; or he may appoint Bean, and remove him if he finds him incompetent. But then, if Bean is continued on the list and is the only veteran on it, or if his application is considered as exhausted by one certification and he makes a new application, the statutes, literally construed, make it the duty of the commissioners to put his name again at the head of the list for appointment, and on requisition by the Governor again to certify him for appointment, and so on, *toties quoties*, so long as he remains on the list.

It is to be noticed that the class of veterans as defined by

the statutes is not a class which anybody can become qualified to enter by any services which he may perform or by any attainments which he may acquire, but it is a class fixed and determined by services which were rendered a long time before any of the statutes were passed. It is also to be noticed that the fact of having been a veteran within the meaning of the statute in and of itself has little tendency to show that the applicant is specially qualified to perform the duties of many of the offices to which the civil service statutes and rules relate. The principal purpose of exempting veterans from submitting to an examination must be that veterans sometimes may be appointed to an office or employment who would be found on examination not qualified to perform the duties of the office or employment which they seek. One, and perhaps the chief, purpose of the exemption must be to reward veterans for their services in the war of the rebellion. The reward is not in the nature of a pension or payment of money, but of an office or employment, the salary or pay of which the veteran is to receive. The provisions of the statutes exempting veterans are general in their nature, and relate to all the offices or employments that have been or may be included within the civil service rules. From the earliest times most nations have conferred honors and emoluments upon those persons who have rendered distinguished service to the State, particularly in war. These honors and emoluments have been conferred upon persons voluntarily selected by the legislative body or the sovereign power, and pensions and rewards sometimes have been given to whole classes of persons, of which the statutes of the Commonwealth relating to the "aid to soldiers and sailors and to their families," and the statutes of the United States relating to pensions, are well-known examples; but the statute of 1895 under consideration affords the first instance, so far as we know, in this Commonwealth, where the appointing power has been compelled to appoint persons of a certain class to office in preference to all other persons, whether they are or are not thought to be qualified for the office by the appointing power or by some public officer or some impartial and disinterested board of officers or persons invested by law with the power and responsibility of determining the qualifications of the persons to be appointed.

The Legislature, in establishing offices not provided for by

the Constitution, has often required that the persons or some of the persons to be appointed shall possess certain qualifications, or that some of them shall be women and some men ; but in all cases, so far as we are aware, the qualifications required bear such a relation to the duties imposed that they tend to secure that kind and degree of knowledge, experience and impartiality which are requisite for the satisfactory performance of their duties, and it is open to any person to acquire the qualifications required. When women are to be appointed, there is a satisfactory reason in the nature of the office or employment why this should be done. In every such case some discretion usually has been left to the appointing power in the selection of the particular persons to be appointed. The peculiarity of the civil service statutes and rules, if St. 1895, c. 501, §§ 2 and 6, be enforced, is that very little is left to the discretion of the appointing power in the selection of persons if there are veterans who wish to be appointed. The Civil Service Commissioners, in making up the lists and in certifying the persons to be appointed, must proceed in a certain way designated by the statutes and the rules, and the appointments must be made, if at all, from the persons so certified. Before the passage of St. 1895, c. 501, it was within the discretion of the appointing power whether veterans who had been put upon any list without an examination, pursuant to St. 1887, c. 437, should or should not be certified for appointment by the commissioners ; and it was also in the discretion of the appointing power, whether, if such veterans were certified, they should be appointed. But if veterans make application under St. 1895, c. 501, § 2, they are to be preferred “ for certification and appointment in preference to all other applicants not veterans except women ; ” and, as separate lists are made up for the different offices and employments, appointments from each list must be made from veterans, if any man is appointed and there are veterans on the list.

It ought perhaps to be considered whether it is intended that veterans who make application for employment in the public service under St. 1895, c. 501, §§ 2 and 6, shall not only file a petition in accordance with § 6, but shall also conform in their application to the requirements of the second section of Rule XII. of the civil service rules, pursuant to § 2. We are of opinion that it was the intention of the statute that the application under this statute of a veteran who does not wish to sub-

mit to an examination should be made in accordance with the requirements of both the second section of Rule XII. of the civil service rules and § 6 of the statute. (See opinion in 145 Mass. 587.)

It may perhaps be doubted whether it is the intention of the statute of 1895 that, if a veteran makes application pursuant to § 2, his application shall be taken to be conclusively true, or that the commissioners shall inquire into the truth of the statements contained in the application. St. 1891, c. 140, gives the commissioners ample power to make investigation in all cases requiring it, and the only question is, what is the intention of the St. of 1895? The commissioners must of necessity inquire and determine whether an applicant is a veteran according to the meaning of this statute, otherwise he has no right to make the application under § 2. We have, however, found it unnecessary in the present case to determine whether the commissioners may also inquire into the truth of the statements made in the application to the effect that he has not suffered loss of limb or other physical impairment which incapacitates him from performing the duties of the position which he seeks; that he is a citizen of the United States; that he does not habitually use intoxicating beverages to excess, and is not a vender of intoxicating liquor; and has not been convicted within one year of any offence against the laws of the Commonwealth. Whether they can make these inquiries or not, we are unable to see in the statutes any indication that the Legislature intended that the commissioners should examine a veteran who makes application under St. 1895, c. 501, §§ 2 and 6, with reference to his moral character, or his mental acquirements and capacity to perform the duties of the position which he seeks. If the commissioners were to do this, and were to certify to the appointing officer only such veterans as they found to be of good moral character and mentally as well as physically qualified to perform the duties of the position which they seek, there would be little difference under this statute between the position of veterans who desire an appointment without having passed any examination and that of those who submit themselves to an examination. We think the intention of the statute of 1895 is that the sworn statement of the applicant that he is qualified to perform the duties of the position which he seeks, accompanied by a certificate from three citizens of good repute in the community that

they know said applicant to be fully competent to perform such duties, is to be taken by the commissioners for the purpose of certification to the appointing power, and by the appointing power as conclusive upon the mental and moral qualifications of the applicant. The certificate of three citizens is not required to be under oath, and it may be made by any three persons of good repute whom the applicant may select; it is not made under any sense of official responsibility, and the persons making it are not required to be impartial or disinterested. They may be friends, or relations or servants of the applicant. The St. of 1895, c. 501, § 2, provides "that the age limit now established by the civil service rules with regard to appointments in the police and prison service and fire department may be applied to" appointments under this section; but this seems to be the only clear provision that the commissioners may exclude from certain offices and employments veterans who make the requisite application, accompanied by the requisite statement and certificate, and the exclusion can be made only on account of age in accordance with the age limit established by the civil service rules when St. 1895, c. 501, took effect.

It is the contention of the petitioner that the privileges given to veterans by St. 1895, c. 501, §§ 2 and 6, are in violation of the principles which underlie our system of government implied in the Constitution of the Commonwealth, and also are in violation of certain express provisions of the Constitution. The express provisions relied on are found in articles 6 and 7 of the Declaration of Rights, and reference is also made to article 9. It is not contended that article 9 in terms is applicable to the present case. This article is as follows: "All elections ought to be free; and all the inhabitants of this Commonwealth, having such qualifications as they shall establish by their frame of government, have an equal right to elect officers, and to be elected for public employments." This article relates to elections and to inhabitants who have such qualifications as are established by the frame of government. The civil service statutes do not relate to elections or to any offices the qualifications for which are established by the Constitution, but the article, so far as it extends, does declare the principle that all persons having the requisite qualifications have an equal right to elect and to be elected to public office.

Article 7 is as follows: "Government is instituted for the

common good ; for the protection, safety, prosperity and happiness of the people ; and not for the profit, honor or private interest of any one man, family or class of men ; therefore the people alone have an incontestible, unalienable and indefeasible right to institute government ; and to reform, alter or totally change the same, when their protection, safety, prosperity and happiness require it." This article is declarative of the end of the institution of government. It may be said to be fairly within the intent of this article that public offices which are the instrumentalities of government ought not to be created or filled for the profit, honor or private interest of any one man, family or class of men, but only for the protection, safety, prosperity and happiness of the people, and for the common good.

Article 6 is as follows: "No man, nor corporation, or association of men, have any other title to obtain advantages, or particular and exclusive privileges, distinct from those of the community, than what arises from the consideration of services rendered to the public ; and this title being in nature neither hereditary, nor transmissible to children, or descendants, or relations by blood, the idea of a man born a magistrate, lawgiver or judge, is absurd and unnatural." From the conclusion of this article it is manifest that it is mainly directed against hereditary offices and privileges, but it is contended that this is not its whole purpose. It is said that the mention of corporations and associations of men shows that hereditary privileges were not solely intended, because corporations and associations of men have no heirs, although they may be perpetual. We think it obvious that, whatever may be the advantages or particular and exclusive privileges mentioned, they may include advantages and privileges for life or a definite period of time, as well as hereditary advantages and privileges. We think, for example, that a peerage for life, with the privileges which attach to a peerage by English law, cannot be conferred in this Commonwealth upon any person, any more than can an hereditary peerage.

It has been argued, on the one hand, that the words "other than what arises from the consideration of services rendered to the public" mean or include services which have been rendered to the public in the past ; and that if a man, corporation or association of men has rendered services to the public in the past, it is consistent with this article that he may obtain advan-

tages or particular and exclusive privileges in consideration of those services. On the other hand, it is argued that it is only in consideration of services to be rendered to the public therefor that a man, corporation or association of men may obtain advantages or particular and exclusive privileges. This provision is said to have been taken from the Declaration of Rights in the Constitution of Virginia of 1776, Art. IV., where it reads as follows: "That no man or set of men are entitled to exclusive or separate emoluments or privileges from the community, but in consideration of public services, which, not being descendible, neither ought the offices of magistrate, legislator, or judge to be hereditary."

In our opinion, the meaning of these words in this article, so far as they are applicable to public officers, is that only in consideration of services to be rendered to the public therefor can a man, corporation or association of men obtain advantages or particular and exclusive privileges distinct from those of the community. A person may obtain the advantages or privileges attached to a public office in consideration of his performing the duties of the office. It is for the purpose of rendering service to the public in a public office that advantages and privileges distinct from those of the community may be obtained. The meaning of this article was somewhat considered in *Hewitt v. Charier*, 16 Pick. 353, and it was held that St. 1818, c. 113, was not in violation of the article. It was there held that the leading purpose of that statute was to guard the public against ignorance, negligence and carelessness in the practice of physic and surgery, and that the exclusive privileges granted to such persons as shall have been licensed by the officers of the Massachusetts Medical Society or have been graduated doctors of medicine from Harvard University were only incidental to the leading purpose of the statute. In that case, as in others where a license is required before any one can engage in certain professions or pursuits, a service is rendered to the public by the exercise on the part of those licensed of the skill, knowledge and experience required to obtain a license, and by the exclusion of ignorant and incapable persons from the profession or pursuit. But it may be questioned whether this article of the Declaration of Rights was intended to apply to private pursuits and employments, and whether it is not to be confined to political and civil rights and privileges.

The original St. of 1884, c. 320, concerning the civil service, required that the rules should provide: "For giving preference in appointments to office and promotions in office (other qualifications being equal) to applicants who served in the army or navy of the United States in time of war and have been honorably discharged therefrom." *Ibid.*, § 14. It may be said that, other qualifications being equal, there are reasons to believe that a veteran soldier or sailor often will make a better civil officer than a person who never has been subjected to the discipline of service in war; and it is distinctly a public purpose to promote patriotism and to make conspicuous and honorable any exhibition of courage, constancy and devotion to the welfare of the State, shown in the public service. These things, we assume, the Legislature may take into account in providing for appointments to office where the qualifications are not prescribed by the Constitution. The St. of 1887, c. 437, provides that veterans may be preferred for appointment to office or employment in the service of the Commonwealth or the cities thereof without having passed an examination under the civil service rules. This statute only gives a discretion to the appointing power, which it may or may not exercise, according to the needs of the public service. (See also St. 1889, c. 473.) St. 1895, c. 501, § 1, amending St. 1884, c. 320, § 14, makes compulsory the certification and appointment of veterans who have been examined and found qualified for the positions they seek, in preference to all other persons, but they must submit to the same examination as other persons. The constitutionality of this section of the statute is not now before us.

The purpose of St. 1895, c. 501, §§ 2 and 6, is to make the appointment of veterans compulsory, if they desire to be appointed, whether the appointing power or the commissioners think they are or are not qualified to perform the duties of the office or employment they seek. Section 6 requires a sworn statement of the applicant that he is qualified to perform the duties of the position he seeks; but it is notorious that persons the least qualified to perform the duties of an office often are the readiest to believe that they are qualified to perform them, and this provision cannot be seriously taken as a reasonable and adequate method of ascertaining the qualifications of applicants for office or employment. Probably it was because the Legislature felt that this requirement was not adequate that the

certificate of three citizens of good repute was also required. But the obvious defect in this requirement is that the applicant may select the three citizens, and they are not required to have any knowledge of the qualifications required, or to be disinterested or impartial, or to act under any sense of public responsibility. A man cannot properly be a judge in his own case, or make his servants and agents the judges. Such a certificate cannot be regarded as a reasonable, impartial and adequate method of determining the qualifications of applicants for appointment to office or employment, if it be necessary under the Constitution that all persons appointed to office or employment should be adjudged by somebody to be qualified to perform the duties of the office or employment.

The principal question of law in this case, broadly stated, is therefore as follows: Can the Legislature constitutionally provide that certain public offices and employments which it has created shall be filled by veterans in preferment to all other persons, whether the veterans are or are not found or thought to be actually qualified to perform the duties of the offices and employments by some impartial and competent officer or board charged with some public duty in making the appointments? If such legislation is not constitutional as regards public offices, the question incidentally may arise whether a distinction can be made between public offices and employments by the public which are not offices.

Public offices are created for the purpose of effecting the ends for which government has been instituted, which are the common good, and not the profit, honor or private interest of any one man, family or class of men. In our form of government it is fundamental that public offices are a public trust, and that the persons to be appointed should be selected solely with a view to the public welfare. In offices which are created by the Legislature, where the method of appointment is not prescribed by the Constitution, the Legislature can take upon itself the responsibility of selecting the persons to be appointed, or can confer the power of appointment upon public officers or boards or upon the inhabitants of cities, towns or districts; but we think that it is inconsistent with the nature of our government, and particularly with articles 6 and 7 of our Declaration of Rights, that the appointing power should be compelled by legislation to appoint to public offices persons of a certain class

in preference to all others, without the exercise on its part of any discretion, and without the favorable judgment of some legally constituted officer or board designated by law to inquire and determine whether the persons to be appointed are actually qualified to perform the duties which pertain to the offices.

There are many employments by the Commonwealth, or by the cities and towns of the Commonwealth, which do not constitute the employee a public officer. The work of the Commonwealth and of the cities and towns must be done by agents or servants, and much of it is of the nature of an employment. It is sometimes difficult to make the distinction between a public office and an employment, yet the title of "public officer" is one well known to the law, and it often is necessary to determine what constitutes a public office. Every copying clerk or janitor of a public building is not necessarily a public officer. With reference to such and similar employments it may be suggested that, if the Legislature can give pensions to veteran soldiers and sailors, it may grant them on condition that the pensioners shall render such service to the Commonwealth, or to its cities and towns, as they can; that they may be employed and paid wages or a salary, partly in consideration of the services they render, and partly in recognition of and as a reward for the services which they have rendered to the Commonwealth in the past. We have not found it necessary, however, in the present case, to consider the authority of the Legislature to grant pensions or pecuniary rewards for past services to the State, whether the pensions and rewards be absolute or conditional upon the rendering of some service, because, in our opinion, the persons appointed to the detective department of the district police force of the Commonwealth, under Pub. Sts., c. 103, and the acts in amendment thereof, are public officers, and not merely employees of the Commonwealth. They are appointed by the Governor for the term of three years, subject to removal by the Governor, and they "have and exercise throughout the Commonwealth all the powers of constables (except the service of civil process), police officers and watchmen, and may be transferred from one district to another in the discharge of their duties; and the Governor may at any time command their services in suppressing riots and in preserving the peace." They give bonds to the treasury of the Commonwealth, and receive a stated salary from the treasury

of the Commonwealth. They have and exercise some of the powers of government. We are of opinion that §§ 2 and 6 of St. 1895, c. 501, so far as they purport absolutely to give to veterans particular and exclusive privileges distinct from those of the community in obtaining public office, cannot be upheld as enactments within the constitutional power of the General Court.

The result is that the commissioners were not authorized by St. 1895, c. 501, §§ 2 and 6, to place without an examination the name of Edward D. Bean at the head of the list to be certified for appointment upon the detective force of the district police of the Commonwealth, in preference to all other applicants not veterans or women; and they should be commanded to strike his name from the list.

Mandamus to issue accordingly.

APRIL 25, 1896.

Commonwealth of Massachusetts.

OPINIONS OF THE JUSTICES OF THE SUPREME JUDICIAL COURT.

To His Honor the Acting Governor of the Commonwealth, and to the Honorable Council.

We, the undersigned justices of the supreme judicial court, in compliance with the order of the Council of June 16 last, and the request of the Acting Governor of June 20 last, copies of which are annexed, respectfully submit the following opinion.

The principal questions are whether sections 2, 3 and 6 of chapter 517 of the Acts of 1896 are within the constitutional power of the General Court. Sections 2 and 3 of the statute are substantially re-enactments of pre-existing statutes which were expressly repealed by section 8. (See St. 1887, c. 437; St. 1889, c. 473; St. 1895, c. 501, § 1.)

The authority given to the General Court by the Constitution to pass statutes on the subject has been often cited, and is found in Part II., c. 1, § 1, Art. 4, of the Constitution. So far as civil officers are concerned, it is full power and authority "to name and settle annually, or provide by fixed laws for the naming and settling all civil officers within the said Com-

monwealth, the election and constitution of whom are not hereafter in this form of government otherwise provided for; and to set forth the several duties, powers and limits of the several civil and military officers of this Commonwealth, and the forms of such oaths or affirmations as shall be respectively administered unto them, for the execution of their several offices and places, so as the same be not repugnant or contrary to this constitution." So far as public employments are concerned which do not constitute the employee a public officer, the authority is "to make, ordain and establish all manner of wholesome and reasonable orders, laws, statutes and ordinances, directions and instructions, either with penalties or without; so as the same be not repugnant or contrary to this Constitution, as they shall judge to be for the good and welfare of this Commonwealth, and for the government and ordering thereof, and of the subjects of the same, and for the necessary support and defence of the government thereof."

Section 2 of the statute of 1896 authorizes veterans to apply for examination under the civil service statutes and rules, and provides that if such veterans pass the examination they shall be preferred in appointment to all male persons not veterans. The effect of the section is that the veterans must first be found qualified by an examination, in accordance with the civil service statutes and rules, to perform the duties of the office or employment which they seek; and, if they are found so qualified, they are to be preferred in appointment to all other persons except women. The General Court may have been of opinion that a person who had served in the army or navy of the United States in the time of the war of the rebellion and had been honorably discharged therefrom, or who was a citizen of Massachusetts and had distinguished himself by valiant and heroic conduct in the army or navy of the United States and had received a medal of honor from the President of the United States, is a person who has shown such qualities of character that it is for the interest of the Commonwealth to appoint him to certain offices or employments in preference to other male persons, if he is found otherwise qualified to perform the duties. The General Court may have so thought, on the ground either that such a person would be likely to possess courage, constancy, habits of obedience and fidelity, which are valuable qualifications for any public office or employment,

or that the recognition of the services of veterans in the way provided for by the statute would encourage that love of country and devotion to the welfare of the State which it concerns the Commonwealth to foster. If such was the opinion of the General Court, we cannot say that it was beyond its constitutional power to enact this section. Of the wisdom of such legislation we are not made the judges. The section does not purport to give an absolute preference to veterans without regard to their qualifications, and the constitutionality of similar legislation was not considered in the recent decision of the court of which we are the justices. (See *Brown v. Russell*, 166 Mass. 14.)

Section 3 of the statute of 1896 gives a discretion to the appointing power to appoint veterans to certain offices and employments without an examination, if in its opinion the needs of the public service require this to be done. Before the enactment of the civil service statutes the qualifications of the persons to be appointed or employed in the offices and employments covered by these statutes usually were left to be ascertained by the appointing power in such manner as it saw fit. The effect of this section is to permit veterans to be appointed to office or employment in the old way, if it seems best to the power having the right of appointment. It may be that the General Court was of opinion that there were certain offices and employments in which it was important that the appointee should have the qualifications usually found in veteran soldiers and sailors, and that the good of the public service would be promoted by giving this discretion to the appointing power. Undoubtedly this, like the preceding section, gives a certain advantage to veterans over other persons, in being appointed to office or employment; but the section implies that the veteran to be appointed shall be found qualified by the appointing power in its own way, and it was not intended to provide for the appointment of veterans who are not qualified to perform the duties pertaining to the office or employment which they seek. The section does not necessarily exclude the appointment of other persons, if the appointing power is of opinion that the appointment should be made under the civil service statutes and rules. We cannot say that this section is an enactment beyond the constitutional power of the General Court.

The constitutionality of section 6 of the act of 1896 depends,

we think, upon the meaning to be given to it. If the section means that the Civil Service Commissioners shall establish rules to secure the employment of veterans in the labor service of the Commonwealth and of the cities and towns, in preference to all other persons except women, which rules shall secure the employment of veterans, whether they are or are not found qualified to perform the labor which pertains to the service, and thus shall compel the Commonwealth and its cities and towns to pay wages to veterans for labor which they do not and cannot perform, we should have great difficulty in sustaining it as a constitutional enactment. This section does not relate to public offices, and, without suggesting that any distinction can be made between public offices and public employments in the matter we are considering, the section was passed under the authority given to the General Court to make all manner of wholesome and reasonable laws. We doubt whether a statute which purports to compel the Commonwealth and its cities and towns to employ in the labor service persons who are not able to perform the labor, and to pay them wages as laborers, could be held to be either wholesome or reasonable. But, if the section means that the Civil Service Commissioners shall establish rules to secure the employment of veterans in the labor service of the Commonwealth and its cities and towns in preference to all other persons except women, if the veterans are found competent to perform the labor, we think the enactment is within the constitutional power of the General Court. The civil service rules provide generally that applicants for the labor service who produce satisfactory evidence of their capacity for labor and their habits as to industry and sobriety shall be registered in the order of their application, at such convenient times and place or places as shall be designated by the commissioners. (Rule XLV., § 1.) The special regulations in relation to the employment of laborers and mechanics which have been adopted by the commissioners provide not only that the applicant must produce a certificate, signed by two reputable citizens of his city, of his capacity for labor and of his habits of industry and sobriety, but also that before entering the name of an applicant on the register such further inquiry may be made in regard to his character and capacity as the commissioners may deem practicable or expedient; and that, in case an applicant is found

to be unfit or in any way disqualified to perform the service which he seeks, his name shall not be entered on the register, and the reason therefor shall be endorsed on the applicant's statement. (Regulations 4, 7, 9.) These rules and regulations were adopted before the passage of the statute of 1896, and were contained in the reports of the Civil Service Commissioners to the General Court. It may be presumed that the General Court knew of the existence of these rules and regulations when they passed the statute of 1896; and the authority given by the sixth section to establish rules to secure the employment of veterans in the labor service in preference to all other persons except women, considered with reference to the existing statutes and rules, makes it reasonable to infer that the intention of the General Court was that the rules so established might provide for determining in some manner that the veterans who make application to be employed in the labor service should have the capacity to perform the labor involved in the service. The section should be so construed as to be within the constitutional power of the General Court, if it reasonably can be. Without unequivocal language to that effect, we should hesitate to impute to the General Court an intention to give to persons entirely incapacitated for labor an absolute right to be employed and paid in the labor service of the Commonwealth and of its cities and towns, as if they performed the labor. Such a provision would seem inconsistent with a purpose to promote efficiency in the public service and to legislate in the interest of all the people. The requirement that the commissioners shall establish rules to secure the employment of veterans "in preference to others" implies that the employment of veterans is to be regulated in the interest of the public service as well as to secure to them a preference, and that they are not to be employed in the labor service if they have not the ability to labor. It could hardly have been the intention of the General Court that women should be employed in the labor service who could not perform the labor, or that the proviso of St. 1896, c. 449, should give an absolute preference to veterans in employment, even although the veterans were incapable of performing the duties of the employment.

The sixth section of St. 1896, c. 517, does not purport to define what the preference shall be which the rules established by

the commissioners are to secure, but the preference intended is probably not greater than the preference conferred by the second and third sections of the statute.

Unless, then, the appointing officers call for the names of veterans for labor service whose qualifications have not been ascertained by the commissioners in any manner, we think that the commissioners may provide by rules for determining the qualifications of the veterans. Construing the sixth section in this way, we are of opinion that it is an enactment within the constitutional power of the General Court. Mr. Justice Holmes concurs in this construction of the section, but is not prepared to say that it would be unconstitutional upon a different construction.

The remaining questions relate to the civil service rules which the commissioners have prepared and submitted to the Acting Governor and Council for approval. We perceive no constitutional objection to the approval of these rules, although we think that the rule relating to the appointment of veterans in the labor service under the sixth section of the statute of 1896 might have made explicit provisions for determining the qualifications of the veterans who seek service under this section, unless the appointing officers call for veterans who have not submitted to anything in the nature of an examination.

WALBRIDGE A. FIELD.

OLIVER WENDELL HOLMES.

MARCUS P. KNOWLTON.

JAMES M. MORTON.

SEPT. 25, 1896.

To his Honor the Acting Governor of the Commonwealth and to the Honorable Council.

In the opinion of the undersigned, there is no difference in the constitutional principles which govern the selection of persons for public office and for public employment, and the reasons given in *Brown v. Russell*, 165 Mass. 14, for holding St. 1895, c. 501, §§ 2, 6, unconstitutional as to public offices, apply to public employments as well.

In both cases, the important matter is to get the best possible service, and the selections should be made with reference to the qualifications or fitness for the performance of the duties which

are to be performed. And, since this is so, it is not within the constitutional power of the Legislature to fix as a decisive test anything which does not bear such a relation to the duties to be performed as to show special fitness for the performance of those duties.

The fact of being a veteran, as defined in St. 1896, c. 517, does not bear such a relation to the duties of a present office or employment in the civil service of the Commonwealth that it can be made a decisive test in the selection of persons for such offices or employments. A veteran may or may not have special fitness for such positions. Certainly to have served honorably in the army or navy is not the only way in which one can acquire such fitness. However useful the training may be which many of the veterans received in the army or navy, it cannot be laid down as a universal proposition that every veteran who can pass the examination to which all applicants are subjected is better qualified for such office or employment than any other person now is or can become. The appointing power cannot be required to pass by cases of conspicuous fitness and to accept service of a lower character, simply because a veteran applies for the position. In requiring this to be done, the statute sets apart a class of persons who, in consequence of what they did in the war, and irrespective of present qualifications, are to be preferred, so that nobody else, however well fitted or however meritorious by reason of valuable or distinguished services in other occupations calling for fidelity and fortitude, can be considered as eligible for appointment, or can become eligible in the future, in competition with them. No matter what may have been the services, training and discipline, or what may be the natural ability or acquired skill of others, the power of selecting them for public office or employment is cut off. This involves a compulsory disregard of actual fitness and qualifications, to the detriment of the public service.

Nor can the fact that a veteran has passed the prescribed examination be made a decisive test in favor of his appointment. This may merely show that he has the *minimum* qualifications required, but cannot be made to entitle him to a compulsory preference over those who are better qualified.

It is, therefore, not within the constitutional power of the Legislature to enact that veterans shall be preferred for public office or employment to others who may have higher standing

or superior qualifications ; and the first and third questions are answered in the negative.

The second question is answered in the affirmative, for the reasons given in the opinion signed by a majority of the justices.

The fourth and fifth questions are answered in the negative, to the extent hereinbefore explained.

CHARLES ALLEN.

JOHN LATHROP.

JAMES M. BARKER.

Commonwealth of Massachusetts.

OFFICE OF CIVIL SERVICE COMMISSION,
Rooms 151-152, STATE HOUSE, BOSTON, May 6, 1896.

Hon. H. M. KNOWLTON, *Attorney-General, Commonwealth Building, Boston.*

DEAR SIR :— General requisitions are received almost daily for certification of persons to fill positions in the various classes of the public service, classified under the civil service rules, without expression of a desire for the certification of veteran soldiers or sailors, or any one of them, under civil service Rule XII., prepared under chapter 437 of the Acts of 1887 (the soldier exemption act).

In view of chapter 501 of the Acts of 1895 (the veteran preference act), and especially of section 2, and of the recent decision and opinion of the supreme judicial court in the suit of *Brown v. the Civil Service Commissioners*, in regard to that act, the commissioners respectfully request your official opinion upon the following questions :—

First. Whether, in certifications upon such requisitions (not calling for veterans) for positions classified and described in the three classes under Schedule A, civil service Rule VI., veterans who have applied for appointment to such positions without examination under section 2 of chapter 501 of the Acts of 1895 must be certified and appointed under said section, as construed by the supreme judicial court in said opinion?

Second. Under similar circumstances, must veterans applying under said section of the act of 1895 for positions in Class 1 of Schedule B, under civil service Rule VI., be certified and appointed?

MASSACHUSETTS CIVIL SERVICE.

Third. Must veterans so applying for positions in classes 5, 6, 7, 8, 9, 10 and 11 of said Schedule B, or in any of such classes, be certified and appointed?

Fourth. Where requisitions are made for public laborers and mechanics in Schedules C and D under civil service Rule XLIV. (not expressly calling for veterans), must veterans who have applied be certified and employed, in view of section 2 of chapter 501 of the Acts of 1895 and the opinion of the court thereon?

The commissioners enclose a copy of the opinion of the court referred to above.

Very respectfully yours, CHAS. THEO. RUSSELL,
Chairman.

Commonwealth of Massachusetts.

OFFICE OF THE ATTORNEY-GENERAL, BOSTON, May 26, 1896.

HON. CHARLES THEODORE RUSSELL, *Chairman Civil Service Commissioners.*

DEAR SIR: — Your letter of May 6 calls for my opinion as to whether §§ 2 and 6 of Sts. 1895, c. 501, in view of the case of *Brown v. Civil Service Commissioners*, 165 Mass., are in force with respect to certain offices and employments set forth in your letter. The four questions you propound comprehend practically the entire classification of offices and employments, which by your rules are required to be filled by certification from your department, excepting such as are plainly included within the terms of the decision in the case above quoted.

The opinion of the court in *Brown v. Civil Service Commissioners* does not hold that the veterans preference act is unconstitutional as to positions in the service of the Commonwealth, which are mere employments and are not offices. It only decides that the sections under considerations, “so far as they purport absolutely to give to veterans particular and exclusive privileges distinct from those of the community in obtaining public office, cannot be upheld as enactments within the constitutional power of the General Court.” How far the Legislature may give preference to veterans in disposing of the many employments which it creates and provides for, but which do not constitute the employee a public officer, the court in express terms refrains from deciding.

But the reasoning of the court deals almost exclusively with the question of public offices. Throughout the opinion a clear distinction is made between public offices and public employments ; and the decision of the court may be fairly said to turn upon the proposition, as stated in the opinion, that “ it is inconsistent with the nature of our government, and particularly with articles 6 and 7 of our Declaration of Rights, that the appointing power should be compelled by legislation to appoint to public offices persons of a certain class in preference to all others, without the exercise on its part of any discretion, and without the favorable judgment of some legally constituted officer or board designated by law to inquire and determine whether the persons to be appointed are actually qualified to perform the duties which pertain to the offices.”

There is no intimation in the opinion that the considerations which apply to public officers would also be applicable to mere employments. It is even suggested that such positions might be given to veterans “ partly in consideration of the service they render, and partly in recognition of and as a reward for the services which they have rendered to the Commonwealth in the past.”

Without venturing to express an opinion whether the distinction suggested is sound, or will be sustained by the court when the question is directly raised, I think, inasmuch as positions which are employments merely and are not public offices, are expressly excluded, not only from the reasoning of the opinion but from the decision, that it is the duty of your board to assume that the law is still in force as to such positions. The presumption in favor of legislative acts still binds your board, excepting so far as the court has plainly instructed you to the contrary.

This raises the important question, What are public offices? Here, again, the court abstains from laying down any general rule. Indeed, Field, C. J., expressly says “ it is sometimes difficult to make a distinction between a public office and an employment.” As is stated by the court, the terms “ public office ” and “ public officer ” are often used, and have acquired a well-understood signification. The difficulty lies in the application of general definitions to particular cases. The determination of an individual case, especially one that is near the line, may require an examination not only of the statutes bearing upon it, but of all the facts and circumstances connected

with it. I prefer, therefore, to answer your questions generally, leaving particular cases to be determined as they arise.

Among those who are declared with more explicitness by the court to be public officers may be mentioned the following: sheriff, *Fowler v. Beebe*, 9 Mass. 231; deputy sheriff, *Bucknan v. Ruggles*, 15 Mass. 180; coroner, *Nason v. Dillingham*, 15 Mass. 170; constable, *Elliott v. Willis*, 1 Allen, 461; public weigher of vessels, *Com. v. Woods*, 11 Met. 59; field driver, *Gilman v. Holt*, 4 Pick. 258; assessor, *Pease v. Smith*, 24 Pick. 122; surveyor of highways, *Williams v. Adams*, 3 Allen, 171; postmaster, *Keenan v. Southworth*, 110 Mass. 474; commissioners appointed by the governor, *Fitchburg Railroad Co. v. Grand Junction Co.*, 1 Allen, 582; town liquor agent, *Dwinells v. Parsons*, 98 Mass. 470; county commissioners, *New Haven and Northampton Co. v. Hayden*, 117 Mass. 433; district attorney, *Bullock v. Aldrich*, 1 Gray, 206; city physician, *Com. v. Swasey*, 133 Mass. 538; city engineer, *Chandler v. Lawrence*, 128 Mass. 213; town clerk and moderator, *Attorney-General v. Crocker*, 138 Mass. 218; road commissioner, *Clark v. Easton*, 146 Mass. 93; police officer, *Phillips v. Boston*, 150 Mass. 491, 494; and master of house of correction, and superintendent and instructor thereof, *O'Hare v. Jones*, 161 Mass. 391. On the other hand, the court says, in *Brown v. Civil Service Commissioners*, that "every copying clerk or janitor of a public building is not necessarily a public officer." From these illustrations, and upon general considerations, it may be said that a public officer is one who by the authority of the Legislature, either through appointment or election, is charged with a duty public in its nature, and which concerns the government of the State and the rights of its citizens. Whoever is entrusted with powers which concern the administration of the affairs of the Commonwealth or the rights of the public, and is appointed or elected to that duty under legislative authority, may be said to be a public officer. Whatever just criticism may be made upon this definition is yet, I apprehend, more properly directed against the attempt to define than the definition itself. It is not easy to lay down any rule which may not be subject to modifications in view of specific facts.

Applying these principles to the classifications referred to in your letter of inquiry, it is not difficult to decide that those included in the second divisions, Schedule C and D, to wit,

laborers, are not public officers. Nor can it be properly said, in my judgment, that those described in Schedule A, which includes clerks, copyists, recorders, bookkeepers, agents, etc., hold public office. So far as I am informed of the facts, I do not see how it may be said that foremen of laborers, engineers, janitors, persons having charge of steam boilers in school buildings, turnkeys, watchmen, drivers of prison wagons, gate-men or guards in public parks and ferries are public officers. The duties of all these are rather in the nature of employment than offices. They take no part in government. They do the work of the Commonwealth. They are its employees, not its officers.

On the other hand, truant officers, although exercising a limited jurisdiction, are yet charged with responsible and important duties. They are directed (St. 1894, c. 498, § 20) to make complaint for truancy, and to carry into execution the judgment thereon; to serve all legal processes issued by the court; also (§ 23) to apprehend and take to school without a warrant all truants found wandering about the streets. They are clothed with authority, and "have and exercise some powers of government." (Field, C. J., in *Brown v. Civil Service Commissioners*.)

The position of drawtender is also one which directly concerns the rights of the public. Pub. Sts. c. 53, § 30, provides that a drawtender shall have full control of passing vessels through the draw, having due regard for the public travel, and shall enforce the ordinances or by-laws relating to the same. This makes him, in my judgment, a public officer. (*Vid. Nowell v. Wright*, 3 Allen, 166.)

I am aware that in the foregoing distinctions I have not exhausted the list of positions upon which your letter calls for my opinion. To do so would require a more intimate knowledge of the statutes relating to those I have omitted, and the facts bearing upon the duties of them, than I now have. In referring to some classes, I did so rather by way of illustration of the general principles stated than as attempting to cover the whole ground. If cases arise which, notwithstanding the foregoing principles, seem to you to be doubtful, I will attempt to deal with them specifically, if desired.

Yours very truly,

HOSEA M. KNOWLTON,
Attorney-General.

MASSACHUSETTS CIVIL SERVICE.

Commonwealth of Massachusetts.

OFFICE OF CIVIL SERVICE COMMISSION,
Rooms 151-152, STATE HOUSE, BOSTON, May 16, 1896.

Hon. H. M. KNOWLTON, *Attorney-General*.

DEAR SIR: — The Civil Service Commissioners request your official opinion upon the following facts: —

The civil service act (chapter 320 of the Acts of 1884), as amended by chapter 95 of the Acts of 1893, exempts from classification, among other officers, "heads of any principal departments of the Commonwealth or of a city." Under the right recognized by the court in the opinion of the justices (138 Mass. 601) to give the rules and classification a limited application, the commissioners, in the classification of the public service, did not include superintendents, *eo nomine*, but in Class 6 of Schedule B, under civil service Rule VI., they did include "foremen and sub-foremen of laborers in the cities of the Commonwealth."

The water commissioner of Boston and the street commissioner have created certain positions under them which they claim are superintendencies, and not positions as foremen, and claim that they do not come within the classification of the rules. These positions are not created by statute, or city ordinance, or other action of the city council. They are created and the duties defined wholly by the respective commissioner, at his will and discretion, and, as he claims, under his general authority to manage his department and regulate its form of business. They are newly created positions. The water commissioner of Boston has thus, without requisition, appointed M. J. O'Brien as "superintendent in the income division," to have charge of the Deacon system and waste of the water department, with a salary of \$1,500 per annum. In reply to our request, the water commissioner has defined his duties in a communication to us, dated May 8, 1896, a copy of which we enclose, marked "Exhibit A."

The superintendent of streets of Boston has appointed, without requisition, Edward Hayden as "superintendent of inspectors in the permit division" of his department, at a salary of \$1,500, and defines his duties in a communication to us, dated May 5, 1896, a copy of which we enclose, marked "Exhibit

B." He has also appointed, in the same manner, Timothy F. Murphy "superintendent of the patrol division of the street department," and defines his duties in a communication to us, dated May 5, 1896, a copy of which we enclose, marked "Exhibit C."

As the same general question is presented in these three appointments, and may arise in subsequent appointments, we call them to your attention together, for your official opinion. We do this for the purpose, so far as possible, of forming some general test or means of distinguishing a foreman, who is classified, from a superintendent or other superior officer, who is not classified. We assume that this depends upon the nature of the duties, rather than upon the official designation of the appointee. In view of the increasing number of these alleged "superintendents" in the departments of the city of Boston, we have selected these cases to submit to you, and beg to request your opinion upon the following questions:—

First. What, if any, is the distinction between a "superintendent" in a city department, under the commissioner or head of the department, and a "foreman," as classified in Class 6 of Schedule B, civil service Rule VI.?

Second. Upon the statement of the water commissioner (Exhibit A), was M. J. O'Brien legally appointed, without requisition, to his present position, or is the position outside the classified service?

Third. Upon the statement of the superintendent of streets (Exhibit B), was Edward Hayden legally appointed, without requisition, to his present position, or is he outside the classified service?

Fourth. Upon the statement of the superintendent of streets (Exhibit C), was Timothy F. Murphy legally appointed, without requisition, to his present position, or is he outside the classified service?

Yours very truly,

CHAS. THEO. RUSSELL,
Chairman.

[EXHIBIT A.]

OFFICE OF THE WATER COMMISSIONER,
CITY HALL, BOSTON, May 8, 1896.

WARREN P. DUDLEY, Esq., *Secretary, Civil Service Commission.*

DEAR SIR:—I have your letter in reference to the case of Superintendent O'Brien, who is at present in charge of the Deacon

system and waste of the water department. I should judge from your letter, where you say that he has only laborers under him, that you have not received full information in regard to his case. I forward you copy of the report of the city engineer on the question of waste, also extract from section 10 of chapter 488 of the Acts of 1895, "An act to provide for a metropolitan water supply," which show the importance of the waste division.

The organization of the division will be as follows: twenty to thirty laborers, among them experienced laborers; two to four foremen; some inspectors, a clerk, an engineer and a superintendent.

Superintendent O'Brien, while nominally carried in connection with the income division, is not responsible to the general superintendent of that division, but directly to myself.

I am of the opinion that the waste division of the service is of the utmost importance, and it is my intention to so administer it, both as regards present methods and future, as to make it one of the most vital branches of the department. This action is made necessary not alone by the power which the Metropolitan Water Board has received from the Legislature on the question of waste, and the report of the city engineer, but on sound business principles.

I am not aware of what the Civil Service Commission's definition of a superintendent may be; but, for the proper administration of the service of the water department, it seems to me that Superintendent O'Brien is one, not alone in name, but in work and responsibility.

Since receiving your letter I have been looking up the question of superintendents, as far as what constituted a superintendent, with my predecessor, Commissioner Smith; and if the rule under which he acted were to be applied to me, I could have superintendents without number. I say this because of the fact that there is now connected with the income division a superintendent, appointed in 1896, who is responsible to the general superintendent of the income division alone. He has charge of nobody, — in short, he is a general without an army. I have been informed that his appointment is satisfactory to the Civil Service Commission.

Very truly yours,

JOHN R. MURPHY,
Water Commissioner.

[Extract from Section 10 of Chapter 488 of the Acts of 1895.]

AN ACT TO PROVIDE FOR A METROPOLITAN WATER SUPPLY.

Said board . . . may inspect the water works and fixtures in any city or town supplied wholly or in part from the works under their charge, and may take all proper measures to determine the amount of water used and wasted and to prevent the improper use or waste of water.

OPINION OF ATTORNEY-GENERAL.

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[Extract from Report of City Engineer Jackson.]

Dry year capacity (gallons Cochituate),	.	41,500,000
Dry year capacity (gallons Mystic),	.	7,000,000
Total,	.	48,500,000

When Reservoir No. 5 is completed the dry year capacity will be increased 14,000,000 gallons.

	Average Daily Consumption, 1895.	Average Daily Consumption, 1896.	Per Cent. Increase over 1895.	AVERAGE MEAN MONTHLY TEMPERATURE.	
				1895.	1896.
	Gallons.	Gallons.			
January, . .	61,004,200	73,747,100	20.9	28.8	24.9
February, . .	71,858,300	77,817,400	8.3	24.6	28.6
March, . .	61,418,900	77,065,600	25.5	34.6	31.9
April, . .	54,712,200	68,264,400	24.9	46.0	47.2

Under these circumstances the water supply is liable, through waste, to become exhausted at any time.

[EXHIBIT B.]

STREET DEPARTMENT, CITY HALL,
BOSTON, May 5, 1896.

Civil Service Commission, State House Extension.

GENTLEMEN : — Replying to your inquiry in regard to my appointment of Edward Hayden as superintendent of inspectors in the permit division of this department, I would say that he has full control and supervision of the force of inspectors, clerks and messengers working on permits issued by this division to any division or department of the city, or to any corporation, company or citizen who requires a permit for the opening or use of the public streets. As previously stated, a number of this force are paid by the larger corporations, but are appointed by me and in the control of this division, and are to be responsible for the faithful performance of their duties to the superintendent of this division, making their reports to him or his clerk ; and he is to be held responsible to me for the entire division force, making his reports directly to me. It is also within his duties to drive about the city and personally superintend work being done under the inspectors, and make his report to this office upon the condition of this work.

MASSACHUSETTS CIVIL SERVICE.

The work of the permit division of this department is not alone for the issuance of permits for openings of the public streets, for the telephone or telegraph conduits and other structures, gas or water pipes, railroad tracks or sewers, but also to master builders, contractors, drain layers, movers of buildings, people who wish to project a shelf, sign or awning over the sidewalk, and for numerous other things for which the Board of Aldermen issue an order. As previously stated in my letter of notice to you, I deemed it advisable to place a man of experience in charge of this division, as I felt justified in doing so on account of the increase of business.

Trusting that this explanation of the duties of the superintendent of this division will be satisfactory to your Honorable Board, I remain,

Yours respectfully,

BENJ. W. WELLS,

Superintendent of Streets.

[EXHIBIT C.]

STREET DEPARTMENT, CITY HALL,

Boston, May 5, 1896.

Civil Service Commission, State House Extension.

GENTLEMEN:—In reply to your communication of recent date, I would state that Timothy F. Murphy was appointed superintendent of the patrol division of the street department on the sixth day of March, 1896, and immediately took charge.

In this position he has full charge of the push-cart division of the entire city, and is responsible for the faithful performance of the work done by this division, personally visiting the several districts covered by the regular men daily, and none of his work is clerical in its nature.

I am at the present time contemplating the extension of the patrol service over the entire sections of the city (where block paving or asphalt constitutes the street surface), in addition to the regular sweeping force as now employed. If this is feasible upon the recommendations of the superintendent of the patrol division, it will necessitate the employment of an additional force of foremen and inspectors to that now employed in the street-cleaning division, to wit, nine. These latter are in the classified service.

During the greater part of the year the business and a part of the residential sections of the city are swept at night, and I deem it necessary to have this work followed up by the patrol division in the day time; and in order to accomplish this, I have placed Mr. Murphy to supervise the work done (as at present) by the inspectors and force of the patrol division, being responsible to me for the work performed by the patrol division of this department.

Respectfully,

BENJ. W. WELLS,

Superintendent of Streets.

Commonwealth of Massachusetts.

OFFICE OF THE ATTORNEY-GENERAL,
BOSTON, July 17, 1896.

HON. CHARLES THEODORE RUSSELL, *Chairman*.

DEAR SIR:—Your letter of May 16 states certain facts with relation to three persons recently appointed to office in the city of Boston, without certification by your board, and asks my opinion as to whether, upon those facts, they were legally appointed in view of the statutes and rules relating to the civil service. Your letter further asks “what, if any is the distinction between a superintendent in a city department, under a commissioner or head of the department, and a foreman, as classified in Class 6 of Schedule B of civil service Rule VI.”

It is not always practicable to lay down general definitions sufficiently broad and precise to cover all possible cases that may arise. It has been the practice of this office to refrain from attempting to reply to inquiries calling for a statement of general principles; but rather to determine specific questions as they arise. The general question in your letter above quoted is within this rule. To undertake to lay down in advance a clear distinction between a superintendent and a foreman is not practicable nor necessary. It is possible, however, to establish some general principles of construction of the meaning and intent of the civil service statutes, and of the rules created by your board in pursuance of those statutes, which may be of assistance in the consideration of specific cases.

The civil service rules have, and are intended to have, only a limited application. Your board has not undertaken, in the classification established by its rules, to comprehend all the departments of public service with which under the statutes it is authorized to deal. This right of limited application is recognized by the court. (*Vid.* Opinion of the Justices, 138 Mass. 601.) Certain officers are excepted from the operation of the civil service rules by law. Sts. 1893, c. 95, expressly exempts, among others, “heads of any principal departments of the Commonwealth or of a city.” Subject to this and perhaps to some other exception in the same statute, all the appointive officers in a city government may be classified by your rules. I do not understand, however, that you have attempted so to include the entire civil service of cities. On the contrary, there

are many officers, not heads of principal departments, who are not classified under your rules. There are officers exercising duties of supervision, superintendence and inspection, who, on the one hand, do not come within the exception of the statutes exempting them from your rules; and who, on the other hand, are clearly not within the classification established by the rules. (*Vid.* Opinions of the Attorney-General, 1892, October 23; 1894, December 4.) So far as the question under discussion is concerned, your rules only attempt to classify such officers as are designated as "foremen and sub-foremen of laborers" and "inspectors of work."

I assume that your general inquiry is intended to suggest the question whether there is any intermediate ground between persons who are "heads of principal departments" under the statute of 1893, and who are thereby exempted from the rules, on the one hand, and "foremen and inspectors," on the other hand, who are in the classified service. If the classification of your board were intended to be comprehensive, there might be some ground for holding that it was intended to include all persons doing the work of superintendents, between the grade of a head of a principal department on the one hand, and actual laborers on the other hand. But your rules, as before stated, are intended to have a limited application only; and it cannot be said, therefore, that such intermediate superintendents are to be classed as foremen unless the meaning of the words "foremen" and "inspectors" actually require such an interpretation.

There is no absolute line of distinction between a superintendent and a foreman. A foreman is a superintendent in one sense of the word, and a superintendent may not be improperly called a foreman. But the word "foreman," in your rules, is to be taken in its usual and ordinary signification. As the word is commonly employed, it undoubtedly means a person who has immediate charge and oversight of a gang of laborers, directing them in their work and seeing that they keep at work. On the other hand, a superintendent, as applied to civil offices, is one who has charge and oversight of a department of government, either a principal or a subordinate department. He is an officer to whom is entrusted responsibility, judgment and skill. The distinction between a foreman under your rules and a superintendent was well suggested by my predecessor, Mr. Pillsbury, when he said, speaking of the rules of your

board, "it appears to me that the civil service act and the rules should, in general, be so construed as to distinguish between positions of routine, so to speak, which ordinarily do not involve administrative or discretionary powers, on the one hand; and, on the other, positions which involve the exercise of judgment, discretion, authority and responsibility; and that the general scheme is to include the former and not to include the latter class within the system." (Attorney-General's opinion, 1892, October 23.)

This general distinction seems to me to be sound. A foreman of laborers is entrusted only with the duty of seeing that his men keep at work. The meaning of this word is fixed and modified by the clause "of laborers" which follows and limits it. A superintendent has that general charge and oversight of the work of a department, especially in its relation to the public, for whose benefit the department was created; and, under the authority of his chief, if he himself is not the head of the department, represents the administration of the government.

The foregoing principles appear to be conclusive of two of the three cases submitted in your letter.

M. J. O'Brien has been appointed "superintendent in the income division" of the water department. His duties, as they appear by the letter annexed to your communication, the statements of which for the purposes of this inquiry I am to take as conclusive, are to have charge of the Deacon system and waste of the water department. This division employs twenty or thirty laborers, some of them experienced laborers; two to four foremen; some inspectors, a clerk and an engineer. This division is intended to enforce the provision of Sts. 1895, c. 488, § 10, which provides that the board "may inspect the water works and fixtures of any city or town supplied wholly or in part from the works under their charge, and may take all proper measures to determine the amount of water used and wasted and to prevent the improper use or waste of water."

On these facts I do not think that it can be properly said that O'Brien is merely a foreman of laborers. He has charge of a department of work comprising laborers, inspectors, a clerk and an engineer. His duties are not merely to see that laborers work faithfully; they comprehend the administration of the powers and duties of the government, so far as they relate to waste in the public water supply.

MASSACHUSETTS CIVIL SERVICE.

Edward Hayden has been appointed "superintendent of inspectors in the permit division" of the department of streets. His duties, as stated in the letter annexed to your communication, comprise the control and supervision of the force of inspectors, clerks and messengers working on permits issued by the permit division to any other department of the city, or to any corporation or company which requires a permit for the opening or use of the public streets. A number of this force are paid by corporations requiring the opening of the streets and are under his control. It is stated to be the further duty of Hayden to go about the city and superintend the work being done under the inspectors, and report to the superintendent of streets upon the condition of the work.

These duties obviously require not merely vigilance in keeping laborers at work, but oversight, discretion and judgment as to the general plan of the work to be done. On the facts I am unable to say that Hayden is within the classification of foreman of laborers; he is that and much more.

Timothy F. Murphy has been appointed "superintendent of the patrol division" of the street department. The letter annexed to your communication states that "he has full charge of the push-cart division of the entire city, and is responsible for the faithful performance of the work done by this division, personally visiting the several districts covered by the regular men daily."

This somewhat meagre enumeration of the duties of Murphy is not sufficient to enable me to determine whether he is anything more than a foreman, or not. Apparently his duties consist merely in seeing that the men under him keep at work. If so, he is a foreman of laborers, with sub-foremen under his charge, and should be appointed under the civil service rules.

It is further stated, in the letter which purports to enumerate his duties, that an extension of the system is contemplated, under which the entire city will be included in Murphy's department, and an additional force of foremen and inspectors employed. The letter to which I refer was dated May 9. Whether any such extension as is proposed in the letter has been made, or not, I have not been informed. If further consideration of Murphy's case is desired, I must request to be advised more fully upon the facts.

Very truly yours,

HOSEA M. KNOWLTON,
Attorney-General.

THE CIVIL SERVICE RULES

OF THE

COMMONWEALTH OF MASSACHUSETTS AND THE CITIES THEREOF.

In accordance with the provisions of chapter 320 of the Acts of the year 1884, the following rules have been prepared for the selection of persons to fill certain offices in the government of the Commonwealth and of the several cities thereof, and for the employment of laborers in such cities ; and all rules heretofore prepared and approved are hereby rescinded.

RULE I.

Subject only to the qualifications required to be ascertained in accordance with these rules, the power of appointment and the responsibility of selection are in all cases in the appointing officer or board. The power to remove or reduce, within the classified service, existing by law, on the part of any officer or board, is not impaired by anything contained in these rules.

Appointments
and removals,
responsibility
for.

RULE II.

The commissioners will make and issue, from time to time, as the needs of the service require, such regulations as may be necessary for conducting the business of their office, for the instruction of their secretary, chief examiner and local boards of examiners, and for carrying out the provisions of these rules.

Regulations for
carrying out
rules.

RULE III.

1. For the purpose of making examinations of applicants, the commissioners will designate qualified persons to be members of boards of examiners, and may at any time substitute another person in place of any one so selected.

Commissioners
to designate
boards of
examiners.

2. Whenever the special qualifications required for a position are such that assistance from experts in conducting an examination is advisable, such experts may be designated to

Experts to aid
examiners in
certain cases.

aid the examining board; and, so far as practicable, such experts shall be persons employed in the department to which the applicant seeks admission.

RULE IV.

Commissioners
to apply to
local authorities
for temporary
quarters, etc.

In order that suitable provision may be made for conducting examinations in the several cities, the commissioners will, from time to time, apply to the proper authorities thereof for temporary quarters and for clerical assistance in receiving and filing applications for appointment in the local service.

CLASSIFICATION OF THE SERVICE.

RULE V.

Classification,
two divisions.

1. The offices and places to be filled under these rules shall be classified in two divisions; the first to be known as "The Official Service of the Commonwealth and the several cities thereof;" the second as "The Labor Service."

Amendment.
Went into effect
Oct. 1, 1894.

2. The words "city" or "cities" in the civil service rules shall be construed to include and be applied to any town to which they may be applicable under chapter 267 of the Acts of 1894.

FIRST DIVISION.

RULE VI.

First division,
two Schedules,
A and B.

1. There shall be two schedules under the first division, known as Schedule A and Schedule B.

Schedule A.

Amendment.
See page 124.

2. Schedule A shall include the following classes:—

- Class 1. Clerks, and other persons, under whatever designation, rendering services as copyists, recorders, book-keepers, agents, or any clerical, recording or similar service in the Commonwealth or the several cities, whether paid by time for work done, or by the piece, or in any other way, whose annual compensation is at a rate of less than eight hundred dollars.
- Class 2. Persons occupying similar positions as those included in class 1, whose annual compensation is at the rate of eight hundred dollars and over.
- Class 3. Inspectors, agents, almoners and all persons, under whatever designation, whose duties may be in part clerical.

Class 4. Stenographers and typewriters.

Class 5. Messengers, and all persons under whatever designation performing messenger service, either permanently or temporarily, in any city of the Commonwealth not included in any of the above classes under this schedule: *provided, however*, one messenger of the mayor in each city is excepted herefrom.

Schedule B.

3. Schedule B shall include the following classes : —

Class 1. Turnkeys, watchmen, drivers of prison wagons, and all others doing police duty in the prisons, houses of detention, reformatories and in all other public institutions and departments of the Commonwealth and the several cities, not included in classes 3 and 4 of Schedule B; also watchmen, gatemen and guards in the public parks and ferries.

Class 2. All members of the regular, permanent substitute and call forces of the fire department in the city of Boston.

Class 3. *a.* The detective force of the district police.
b. The inspection force of the district police.
c. The regular police force and all persons doing permanent police duty in and for and paid by any city of the Commonwealth, except the city of Boston.
d. The special, substitute or supernumerary police force and all persons doing temporary police duty in and for and paid by any city of the Commonwealth, except the city of Boston.

Amendment.
Went into effect
Oct. 1, 1894.

Class 4. All members of the regular and reserve police forces in the city of Boston.

Class 5. Engineers and assistant engineers, draw-tenders and assistant draw-tenders, employed on bridges in the cities of the Commonwealth.

Amendment.
Went into effect
as to engineers
Oct. 1, 1894.

Class 6. Foremen and sub-foremen of laborers in the cities of the Commonwealth.

Class 7. Inspectors of work, and all persons under whatever designation doing inspection service not included in Schedule A.

Amendment.
Went into effect
Feb. 1, 1888.

Class 8. Engineers, janitors and persons having charge of steam boilers and furnaces in the school buildings in the city of Boston.

Amendment.
Went into effect
Nov. 1, 1889.

Class 9. All members of the regular or permanent fire force of any city except Boston, and of any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894, after the mayor and aldermen of such city or the selectmen of such town shall have requested the commissioners to include such force in the classified service.

Amendments.
Went into effect
March 1, 1893,
and May 1, 1895.

Amendment.
Went into effect
Nov. 1, 1893

Amendments.
Went into effect
Oct. 1, 1894, and
May 1, 1895.

Class 10. All truant officers in the city of Boston.

Class 11. Engineers, janitors and persons having charge of public school buildings heated by other means than direct furnace or stove heat, in any city except Boston, and in any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894, after the school committee of such city or town shall have requested the commissioners to include such force in the classified service.

Amendment.
See page 124.

Class 12. Superintendents, assistant superintendents, deputies and other persons, under whatever designation, performing any of the duties of a superintendent, in any city of the Commonwealth or in any town of the Commonwealth accepting the provisions of chapter 267 of the Acts of 1894, excepting so far as the same are exempted by statute.

Class 13. Civil engineers, draughtsmen, transit men, levellers, chainmen, rodmen and all assistants, under whatever designation, except laborers, employed in any city of the Commonwealth or in any town accepting the provisions of chapter 267 of the Acts of 1894.

Class 14. The aids and other persons, under whatever designation, employed in detective service in the office of the State Fire Marshal.

QUALIFICATIONS.

RULE VII.

State service,
residence of
applicants.

1. Applicants for appointment to any position in the service of the Commonwealth, to which these rules apply, must be citizens of the United States who have resided in the Commonwealth for one year next preceding the date of their application. But this restriction shall not apply to positions in which special expert knowledge is required.

City service,
residence of
applicants.

2. Applicants for appointment in the service of a city must be citizens of the United States, who have resided in the Commonwealth for one year and in the city in which they seek service for six months next preceding the date of their application, except where special qualifications are required, and the appointing officer requests in writing that the examination be open to persons who are not citizens or residents.

RULE VIII.

Disqualifica-
tions for ap-
pointment, §§ 3,
4, c. 320, 1884.

No application for appointment will be received from any vender of intoxicating liquor, or any person habitually using

intoxicating beverages to excess; or any person who, within the year preceding his application, has been convicted of any offence against the laws of this Commonwealth.

RULE IX.

1. A good moral character is an essential qualification, and is of paramount importance in determining an applicant's right to admission to the eligible list. Moral character.

2. The burden of proof of good character shall in all cases be upon the applicant, who may be required by the commissioners to furnish evidence thereof additional to the certificates required in his application. Burden of proof.

3. Failure by the applicant to prove good character shall exclude him from examination and from the eligible list; and proof at any time produced to the commissioners of the bad character or dissolute habits of an applicant or eligible, of any criminal or disgraceful act committed by him, or his dismissal for good cause from the public service, shall be sufficient to exclude him from examination or to remove his name from the list of eligibles. Failure to prove good character.

4. No person shall be so excluded from examination, and no one shall be removed from the eligible list, under this rule, except after an opportunity to be heard and upon a finding of the commissioners and a record thereof, containing the names of the commissioners voting therefor and a statement of the grounds of their action. Applicant entitled to a hearing.

RULE X.

1. In Schedule A there is no requirement as to age, height and weight, except that female applicants must be not less than eighteen years of age at the time of filing the application. Amendment as to age. Went into effect Oct. 1, 1894.

2. In Schedule B there shall be the following requirements of age, height and weight:—

a. In class 1 (the prison service) there is no requirement as to age, height and weight, except that applicants for appointment in the State Prison and Massachusetts Reformatory shall be not less than five feet seven inches in height and weigh not less than one hundred and thirty-five pounds. Amendment. Went into effect Oct. 1, 1894.

Amendment.
Went into effect
Oct. 1, 1894.

Amendment.
See page 125.

b. In class 2 applicants for appointment to the fire force of Boston must be not less than twenty-two nor over thirty years of age at the time of making application, and must be not less than five feet five inches in height and weigh not less than one hundred and thirty-five pounds; *provided, however*, that applicants for appointment in the call force of the fire department of Boston, who are serving as call substitutes in said department, may, for the purpose of making themselves eligible under the rules for examination, deduct from their actual age any time not exceeding five years during which they have served in such capacity; and *provided, further*, that applications for appointment as permanent substitutes may be made by persons serving in the call force who are under forty years of age.

Amendment.
Went into effect
Feb. 1, 1888.

c. In class 3 applicants for appointment to the police force of any city other than Boston must be not less than twenty-two nor over forty years of age, and applicants for appointment to the district police force must be not less than "twenty-two nor over fifty-five years of age at the time of filing the application;" *provided, however*, that this limitation as to age shall not apply to persons who served in the army or navy of the United States in time of war, and have been honorably discharged therefrom. In all cases in this class, except the inspection force of the district police, applicants must be not less than five feet seven inches in height and weigh not less than one hundred and thirty-five pounds.

Amendment.
Went into effect
Oct. 1, 1894.

d. In class 4 applicants for appointment to the police force of Boston must be not less than twenty-five nor over thirty-three years of age at the time of filing the application, and must be not less than five feet eight inches in height and weigh not less than one hundred and forty pounds.

Amendment.
Went into effect
March 16, 1891.

e. In all other classes in Schedule B there is no requirement as to age, height or weight, except class 9 and class 10.

As amended
Dec. 14, 1892,
and Aug. 16,
1893.

- f.* Applicants for appointment in class 9 of Schedule B shall be not less than twenty-two nor over thirty-five years of age at the time of making application, and shall be not less than five feet four inches in height and weigh not less than one hundred and twenty pounds; *provided, however,* that call men serving in the fire department may deduct from their actual age any time not exceeding five years during which they have continuously served in such capacity. Amendment. Went into effect March 1, 1893.
- g.* Applicants for appointment in class 10 of Schedule B shall be not less than thirty nor over forty-five years of age at the time of making application. Amendment. Went into effect Nov. 1, 1893.
- h.* In all cases under this rule applicants shall be measured in bare feet and shall be weighed without clothing Amendment. Went into effect Oct. 1, 1894.

APPLICATION.

RULE XI.

1. Application for admission to examinations in the first division may be made at any time, and shall be on blanks in a form prescribed by the commissioners. Applications for appointment to positions in the service of the Commonwealth, and of the city of Boston, may be filed in the office of the commissioners in Boston; applications for appointment to positions in the service of cities other than Boston may be filed with the local board of examiners in the city where service is sought, or at such other place as the commissioners may hereafter designate. Applications, how made.

2. Each applicant for examination must state, on oath, and in his or her own handwriting: 1. Full name, residence and post-office address. 2. Citizenship. 3. Age. 4. Place of birth. 5. Health, and physical capacity for the public service. 6. Right of preference by reason of military or naval service. 7. Previous employment in the public service. 8. Business or employment, and residence, for the previous five years. 9. Education. 10. Such other information shall be furnished as may reasonably be required touching the applicant's fitness for the public service. Form of applications.

RULE XII.

1. The word "veteran" in these rules shall mean a person who served in the army or navy of the United States in the Definition of word "veteran." Amendment. See page 125.

time of the war of the rebellion, and was honorably discharged therefrom; and also a citizen of Massachusetts who has distinguished himself by gallant and heroic conduct while serving in the army or navy of the United States, and who has received a medal of honor from the President of the United States.

Veterans to
file application.
Amendment.
See page 125.

2. Any veteran desiring appointment to office or employment in the service classified under the Civil Service Rules, without having passed any examination provided for therein, shall file an application for such appointment, stating on oath: (1) his full name, residence, and post-office address; (2) the office he seeks; (3) that he desires appointment without having passed any examination provided for by the Civil Service Act or the rules thereunder; (4) his service in the army or navy of the United States in the time of the war of the rebellion, and discharge therefrom; (5) that he has not suffered loss of limb, or other physical impairment, which incapacitates; (6) his citizenship; (7) that he does not habitually use intoxicating beverages to excess, and is not a vender of intoxicating liquor; (8) that he has not within one year been convicted of any offence against the laws of this Commonwealth.

Application to
be supported
by certificates.

Such application must be supported by certificates that the applicant has all the qualifications required by law of veterans. Such application, if for an office or employment in the service of the Commonwealth or of the city of Boston, shall be filed in the office of the commissioners in Boston; if for an office or employment in the service of any city other than Boston, it shall be filed with the local board of examiners in such city.

RULE XIII.

Applications
must be sup-
ported by cer-
tificates.

Recommendations not re-
ceived from cer-
tain legislators.
§ 5, c. 320, 1884.

Every application must be supported by certificates of good moral character, health, and physical and mental capacity for doing the public work, the certificates to be in such form and number as the commissioners shall prescribe. But no recommendation which may be given by any Senator, member of the House of Representatives, alderman or councilman, except as to the character or residence of the applicant, can be received or considered by any person concerned in making any appointment under these rules.

RULE XIV.

Application for
more than one
class.

No application from the same person will be received for appointment or employment in more than one of the schedules

or classes of the Civil Service as herein designated; but this shall not apply to persons who served in the army or navy of the United States in the time of the war of the rebellion, and were honorably discharged therefrom.

RULE XV.

Every false statement knowingly made by any person in his application for examination, and every connivance by him at any false statement made in any certificate which may accompany his application, or any complicity by him in any fraud, shall be regarded as good cause for excluding him from the eligible list, or for his removal or discharge during probation or thereafter.

Effect of false statements.

RULE XVI.

Defective applications will be returned to applicants with a notice to amend the same. Whenever the application shows that the applicant is not qualified under the rules and regulations, the application will be rejected, and the applicant notified of the reason therefor.

Defective applications returned.

RULE XVII.

The date of the reception of each application shall be endorsed thereon, and the application recorded; and if the applicants for admission to any class are in excess of the number that can be examined at a single examination, they will be notified to appear in the order in which their names are entered; *provided*, that persons who have served in the army or navy of the United States in time of war, and been honorably discharged therefrom, shall have precedence in such notification.

Reception of applications and notice to applicants.

RULE XVIII.

In class 2, Schedule B (the fire department of Boston), applications shall be received only for appointment to the "call force" and the "permanent substitute force." Permanent substitutes may be appointed in the regular force without further examination or certification, *provided* they have served as permanent substitutes at least six months.

Fire department of Boston. — applications, etc.

RULE XIX.

Any person possessing the required qualifications may file a new application after the expiration of six months from his

May file new application.

educational examination, and not earlier; *provided*, that, if his name be upon the eligible list, it shall be withdrawn therefrom upon the filing of his application.

EXAMINATION.

RULE XX.

Examinations,
character, notice
of.

1. All examinations shall be absolutely impartial, practical in their character, and with paramount regard to matters which will fairly test the relative capacity and fitness of the persons examined for the service which they seek to enter.

Political or re-
ligious opinions
not to influence
appointments.
§ 16, c. 320, 1884.

2. No question in any examination shall relate to political or religious opinions or affiliations, and no appointment or selection to an office, or for employment within the scope of these rules, shall be in any manner affected or influenced by such opinions or affiliations.

Time and place
of examination.

3. The examinations shall be held at such times and places as the commissioners may designate, and proper notice thereof given. So far as practicable, the examination of applicants for appointment in the service of a city shall be held therein.

RULE XXI.

Subjects of
examination
designated.

1. The subjects of examination may be designated from time to time by the commissioners, and shall be such as the needs of the service require, and such as tend to prove the qualifications of the applicant for the office sought.

How graded.

2. Proficiency in any subject shall be credited in grading the standing of the person examined, in proportion to the value of a knowledge of such subject in the branch or part of the service which the applicant seeks to enter.

Must obtain
sixty-five per
cent.

3. No one shall be entitled to be certified for appointment whose standing upon a just grading in the examination shall be less than sixty-five per centum of complete proficiency in such of the subjects of the examination as may be designated by the commissioners.

Examinations
where special
skill and experi-
ence are re-
quired.

4. The commissioners may also order examinations upon other subjects of a technical or special character, to test the capacity which may be needed in any part of the classified service which requires peculiar information or skill. Examinations hereunder may be competitive or non-competitive. The application for, and notice of, the special examinations,

the records thereof, and the certification of those found competent, shall be such as the commissioners may prescribe.

RULE XXII.

1. Where physical qualifications are necessary, the commissioners will provide for examinations to determine them. Physical examinations.

2. The examinations to test the physical soundness of applicants for positions in the classified service shall be made by the medical examiners, if for the Commonwealth service, and by the city physicians, or their assistants, if for city service, unless the commissioners shall appoint a physician to conduct such examinations. The results of such examinations shall be certified on blanks furnished by the commissioners. By whom made. Amendment. Went into effect Oct. 1, 1894.

3. Each applicant in any of said classes may be required to undergo such further physical examination as the commissioners may prescribe, adapted to ascertain his special fitness for the service for which he has applied. Any such examination shall be made by a suitable examiner, to be appointed by the commissioners, and the result shall be recorded upon blanks provided for the purpose. Additional physical examination.

RULE XXIII.

No person, while remaining eligible on any register, shall be admitted to a new examination, except in special cases where the office to be filled requires special qualifications. Eligibles not admitted to examination.

ELIGIBLE LIST.

RULE XXIV.

1. Those examined shall be marked and graded according to their excellence, as shown by their examination, and shall have their grade entered upon a register. Separate registers may be kept of those seeking to enter any part of the service in which special qualifications are required. When examined, applicants shall be graded.

2. Every veteran applying for appointment without examination, who shall have furnished satisfactory evidence that he possesses the qualifications claimed in his application, shall have his name entered upon an eligible list without examination. Veterans eligible without examination. Amendment. See page 125.

3. No person shall remain eligible more than one year upon any register, unless he shall so request; in which case, under such regulations as the commissioners may make, his name Eligible one year.

may, without further examination, be continued upon the eligible list for a second year.

RULE XXV.

Persons examined may have a certificate.

The commissioners may give to any person examined a certificate of his or her marking.

REQUISITION AND CERTIFICATION.

RULE XXVI.

Requisition.

Whenever there is a vacancy to be filled in the classified service, the appointing officer or power shall make requisition upon the commissioners for the names of eligible persons.

RULE XXVII.

Certification of eligible persons. Amendment. See page 126.

1. Whenever any officer or board having the power of appointment to any office or employment under these rules shall make requisition, not expressly calling for women, the commissioners shall certify the names of all veterans who have passed the examination for the position sought, in the order of the respective standing of such veterans upon the list; and in case there is no such veteran upon the list, then the commissioners shall certify the names of the three most eligible persons not veterans upon the list. In case such officer or board shall in the requisition request the certification of women, then the commissioners shall certify the names of the three women standing highest upon the eligible list.

2. The appointment or employment shall be made from the list of names so certified, subject to the provisions of the following section:—

3. Whenever any officer or board having the power of appointment to any office or employment shall in his requisition so request, the names of any or all veterans registered under Rule XII. shall be certified, and any of the veterans so certified may be appointed or employed in the office or position sought.

RULE XXVIII.

Certification of specialists.

Whenever the commissioners are notified that proficiency in any special subject is needed in the position to be filled, they may certify the names of three persons on the eligible list having the highest standing (not being below the minimum of sixty-five) in such special subject.

RULE XXIX.

1. No person on any register shall be certified more than three times for the same office, except upon the request in writing of the appointing officer; *provided, however*, if the office requires special or expert qualifications, persons may, in the discretion of the commissioners, be certified more than three times.

No person to be certified more than three times, except, etc.

2. Clause 1 of this rule shall not apply to veteran soldiers or sailors; and it shall not apply to persons other than such veterans, when certified for appointment with a veteran of equal or higher standing, or with one who receives the appointment, though not within the number of those entitled by reason of examination to be certified.

RULE XXX.

[When an appointing officer in his requisition shall so request, the name of any veteran soldier or sailor standing upon the list shall be certified to him for appointment. When an appointing officer in his requisition shall request that the certification be restricted to veteran soldiers or sailors, the names of all veterans upon the list shall be certified. In such case the certification shall specify those who have passed the examination and the marking of each. When an appointing officer shall so request, those entitled by reason of examination to certification, and any veteran named, or all veterans upon the list, shall be certified to him.]

Requisition for veterans.
Repealed.
See page 126.

RULE XXXI.

In case the requisition for certification, or any law or regulation, shall call for persons of one sex, those of that sex shall be certified; otherwise, sex shall be disregarded in certification.

Sex.

RULE XXXII.

If it is shown that any person certified is unsuitable for the position to be filled, the commissioners may certify an additional name; but in every such case the reason for so doing shall be stated in such certification.

Certification of additional names.

APPOINTMENT.

RULE XXXIII.

No person shall be appointed to any office or employment in the first division except in the manner provided by these rules.

Appointment.

RULE XXXIV.

Substitutes,
specials and su-
pernumeraries.

No person serving temporarily, or as a substitute, special or supernumerary official, under whatever designation, in any position in the classified service, except the reserve police and permanent substitute forces of the city of Boston, shall be appointed to any permanent position without requisition and due certification for such position.

RULE XXXV.

Repealed.
See page 126.

1. [*From the names certified the appointing power shall make a selection to fill the vacant place, subject, however, to the provisions of the following clause, giving preference in appointments to certain persons.*]

Repealed.
See page 126.

2. [*In all cases of certification for appointment of examined persons under the Civil Service rules in accordance with the provisions of chapter three hundred and twenty of the acts of the year eighteen hundred and eighty-four, persons certified who have served in the army or navy of the United States in time of war, and been honorably discharged therefrom, shall be appointed in preference to other persons certified who have not a higher standing on the eligible list; and persons thus preferred shall not be disqualified from holding a position in the Civil Service on account of any physical disability, provided such disability does not render them incompetent to perform the duties.*]

Appointing
officer to be
furnished with
examination
papers, etc.

3. In the selection from the persons whose names are certified by the commissioners, the appointing officer, upon written requisition therefor, will be furnished with the applications, the certificates and examination papers of the persons certified; and, in the exercise of his responsible power of selection, he may summon personally before him the certified persons for such verbal inquiries as he may deem proper. All papers furnished upon requisition as above must be returned to the commissioners with the notice of selection.

RULE XXXVI.

Provisional
appointment.
Amendment.
Went into effect
Oct. 1, 1894.

In cases where there is no suitable eligible list and the commissioners are unable to comply with the requisition, they may, in their discretion, allow a provisional appointment, which may continue until a list of eligibles is obtained by examination, or they may authorize the appointing power to select a suitable

person, who shall be subjected to a non-competitive examination, and, if found qualified, shall be certified for appointment; *provided, however*, that, whenever practicable, a competitive examination of applicants for the office shall be held.

RULE XXXVII.

Every original appointment or employment in the permanent service in the first division shall be for the probationary period of six months; at the end of which time, if the conduct and capacity of the person appointed have been found satisfactory to the appointing power, the probationer shall be absolutely appointed or employed, but otherwise be deemed out of the service.

Original appointments shall be for a probationary period.

RULE XXXVIII.

1. Where the compensation of any person in class 8 of Schedule B (engineers and janitors of school buildings) does not exceed three hundred dollars a year, the commissioners may, in their discretion, allow appointment to the position without examination, and no person so appointed shall receive more than said compensation, unless duly certified for appointment after examination; *provided, however*, that when a person appointed under this rule shall have served two years in the position, he may be transferred or promoted upon passing a non-competitive examination.

Appointment in Schedule B, class 8. Amendment. Went into effect Oct. 1, 1894.

2. When the compensation of any person in class 5 of Schedule A (messengers in cities) does not exceed four hundred dollars per year, the commissioners may, in their discretion, allow appointment to the position without examination; *provided, however*, that no person so appointed, or who may be employed as a messenger, when this rule shall take effect, shall be transferred or promoted to any position in the classified service, except that a messenger so appointed or employed without examination may, after two years of continuous service as such, be promoted or transferred upon passing a non-competitive examination.

Amendment. See page 126.

RULE XXXIX.

Every person having the power of appointment to, or employment in, any position in the first division, shall, within ten days, give notice in writing to the commissioners of the name and place of residence of any person appointed or employed in such

Commissioners to be notified of person selected, etc.

position, of the rejection of any such person during or after probation, and of the transfer, promotion, resignation or removal, discharge or death, of any person serving under him, with the dates thereof.

REAPPOINTMENT.

RULE XL.

Reappointment,
no examination
for.
Amendment.
See page 126.

1. No examination shall be required upon a reappointment of any person to the same office immediately upon the expiration of his term of office.

Reinstatement
of persons dis-
missed.
Amendment.
See page 126.

2. Any person appointed to, or employed in, any position in the first division of the classified service, who shall be found or certified to the commissioners by the proper authorities to have been dismissed or separated therefrom without fault or delinquency on his part, may be reinstated without further examination, in the same part or grade of such service at the same office, within six months next following such dismissal or separation.

TEMPORARY SERVICE.

RULE XLI.

No person shall
be appointed for
temporary ser-
vice, unless
regularly certi-
fied, except, etc.
Amendment.
Went into effect
Oct. 1, 1894.

1. Appointments in the first division for temporary service shall be made in accordance with the civil service rules, except in case of emergency, where the public business would suffer from delay in filling the position as herein provided. In no case shall such appointment or employment for an emergency continue for more than ten days, and no reappointment or employment of the same person, or of another to the same position at the end of such period, shall be allowed. And in every such case the officer making the appointment, or furnishing the employment, shall report the same to the commissioners within five days, with the reason therefor and the time for which the temporary appointment or employment is necessary.

Provisional ap-
pointments in
certain cases.

2. If for any sufficient reason it shall be impracticable to certify the names of persons who have passed a competitive examination in due season for any appointment or employment in any position in the first division, the commissioners may provide for a provisional appointment by non-competitive examination or otherwise.

TRANSFER.

RULE XLII.

Transfer within the classified service without examination may be made from a position in one department, office or institution, to a similar position in another department, office or institution, upon the consent in writing of the heads of the respective departments, offices or institutions; *provided, however*, that no person shall be transferred from class 3 of Schedule A, clerical offices requiring special qualifications, who has never passed a competitive examination under the rules, which entitles him to be placed on an eligible list for the position to which he desires transfer.

Transfer without examination.

Police officers may be transferred from one place to another, under section 11, chapter 28, of the Public Statutes, without examination or notice to the commissioners.

PROMOTION.

RULE XLIII.

1. Promotions, within the several schedules and classes of the first division of the classified service, except as hereinafter provided, shall, so far as practicable, be made by successive grades, and may be by competitive or non-competitive examination; *provided, however*, that no person shall be promoted who has not passed a suitable examination under the rules, and has not served at least one year in the lower position.

Amendment.
Went into effect
Oct. 1, 1894.

2. Promotions in class 2 of Schedule B (fire service of Boston) may be by competitive or non-competitive examination; *provided, however*, that promotions from the call to the permanent substitute force shall be made only through competition with all applicants for said force.

3. Promotions in class 3 of Schedule B (police service of cities other than Boston) shall, so far as practicable, be by successive grades; *provided, however*, that no special, supernumerary, substitute, reserve, or temporary police officer, under whatever designation (unless a permanent reserve force in any city is established by act of the Legislature), shall be promoted to the regular or permanent force, or assigned to permanent

MASSACHUSETTS CIVIL SERVICE.

duty, except after competition with all applicants for said force.

4. Promotions in class 4, Schedule B (police service of Boston), shall, so far as practicable, be by successive grades and through competitive or non-competitive examination.

5. Promotions in class 5, Schedule B, from assistant draw-tender to draw-tender, may be made through non-competitive examination.

6. Promotions in class 6 of Schedule B, from assistant or sub-foreman to foreman, may be made through non-competitive examination.

7. Promotions in class 8 of Schedule B (janitors, etc.), except as provided in Rule XXXVIII., may be made without examination; *provided, however*, that no person shall be promoted or transferred from a position in a furnace-heated school to a steam-heated school without having passed a suitable examination in the care and handling of steam.

 SECOND DIVISION.

LABOR SERVICE.

RULE XLIV.

Schedules C and D to include day laborers and mechanics.

Amendment.
Went into effect
May 1, 1895.

Under the second division of the civil service there shall be two schedules, to be known as Schedule C and Schedule D. Schedule C shall include all male laborers and mechanics in the employ of the city of Boston, to be designated as the labor service of the city of Boston. Schedule D shall include all male laborers and mechanics in the employ of each of the other cities of the Commonwealth, or of any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894, to be designated as the labor service of such city or town. The commissioners may from time to time provide for the registration and certification of such employees in any of said cities or towns; and they may, in their discretion, discontinue such registration and certification in any of said cities or towns whenever such city or town shall fail to appropriate such sum of money as, in their opinion, is necessary to provide for the full enforcement of all rules and regulations relating to the labor service of such city or town. Notice of their action in

each case shall be certified to the mayor of such city or the selectmen of such town, and shall be published in one or more newspapers therein.

RULE XLV.

1. Every applicant for labor, who produces satisfactory evidence of his capacity for labor and his habits as to industry and sobriety, shall be registered in the order of his application, at such convenient times and place or places as shall be designated by the commissioners. He shall state under oath the (1) name, (2) age, (3) residence, (4) citizenship, (5) number and relationship of persons depending for support upon the applicant, (6) service in the army or navy in time of war (7) previous occupation (8) references, (9) personal description, and such other information as may be required.

Laborers, how registered.

2. Every applicant shall file a certificate, signed by two reputable citizens, to the effect that he is qualified to perform the labor sought. Every applicant claiming preference as a veteran shall also produce satisfactory evidence of his service in the army or navy of the United States in the time of the war of the rebellion and his honorable discharge therefrom.

Applicants shall file certificates.

3. No certificate from an appointing officer in regard to the capacity of a mechanic or laborer applying for registration shall be received, unless the mechanic or laborer has worked in the department, and the appointing officer has an official knowledge of his capacity.

Certificate from appointing officer shall not be received, except, etc.

4. The commissioners may in their discretion provide and require examination regarding the physical qualifications of any applicant. No applicant shall be registered unless he appears to be qualified therefor.

Commissioners may require physical examinations.

5. When the services of laborers are required, the appointing officer or board shall notify the commissioners, stating the number of men wanted, the precise nature of the labor in which they are to be employed and the time and place of employment. The commissioners shall thereupon certify the names with the residences of veterans registered and qualified for the required labor. In case there is not a sufficient number of veterans so registered and qualified for the required labor, the commissioners shall certify twice the number of men called for, over and above the number of veterans, if any, certified, making an impartial selection, giving preference, *first*, to those

Requisition and certification.

who have had experience in the department, and, *second*, to those having families dependent upon them for support.

Requisition for
young men.
Amendment.
Went into effect
Oct. 1, 1894.

6. In case the appointing officer or board shall in the requisition certify that the labor to be performed is so arduous as to require the services of young and vigorous men, and shall designate a maximum age limit, the commissioners may recognize such age limit, if satisfied of the truth of the certificate.

Selection, how
made.

7. The selection shall be made from the list so furnished, and the names of those employed shall be returned to the commissioners forthwith. At the end of their term of service, the persons so employed may keep their places on the register, upon application to the commissioners and proof that their labor has been satisfactory.

When unable to
fill requisition.

8. In case the commissioners are unable to fill a requisition for laborers, the fact shall be certified to the officer making the requisition, who shall then make the selection under such regulations as the commissioners may from time to time prescribe.

Selection in
cases of emer-
gency.

9. In cases of emergency, where the labor of a department would suffer from delay in filling a vacancy in the labor service, as herein provided, the appointing officer may make a temporary appointment without requisition upon the commissioners; *provided, however*, that in no case shall such temporary appointment or employment continue for more than five days, and no reappointment or employment of the same person or of another to the same position at the end of such period shall be allowed. And in every such case the officer making the appointment or furnishing the employment shall report the same to the commissioners within five days, with the reason therefor.

Suspension for
six months.

10. Any mechanic or laborer suspended and not actually employed in the department in which he is enrolled shall at the end of six months be deemed to be out of the service and shall not be thereafter employed, except after registration and certification by the commissioners; and the appointing officer shall forthwith report to the commissioners the name of any mechanic or laborer so suspended; *provided, however*, that this provision shall not apply to veterans.

Not to be em-
ployed in work
other than that
for which
certified.

11. No mechanic or laborer shall be employed in labor other than that for which he is certified, until after such person shall have been continuously employed in the same labor in the same department for which he was certified for at least two months; *provided, however*, that this provision shall not apply to veterans.

12. Any mechanic or laborer who shall be found or certified **Reinstatement.** to the commissioners by the appointing officer to have been dismissed from the service without fault or delinquency on his part may be reinstated in such service in the same department within three months next following such dismissal.

OFFICES NOT INCLUDED IN RULES.

RULE XLVI.

Upon the request of any officer or board having the power of appointment to any office or position in the service of the Commonwealth, or any of the cities thereof, to which these rules do not apply, the commissioners will furnish names from any list of eligible persons to fill a vacancy in such office or position; or they will, whenever practicable, hold competitive or non-competitive examinations for such office or position.

Applicants for offices not covered by rules may be examined.

The foregoing rules, prepared by the Civil Service Commissioners, are hereby transmitted to the Governor and Council for their approval.

CHAS. THEO. RUSSELL, JR.,
ARTHUR LORD,
EDWARD P. WILBUR,
Civil Service Commissioners.

November 19, 1889.

In Council, November 27, 1889,

Approved: HENRY B. PEIRCE,
Secretary of the Commonwealth.

A true copy.

Attest: WARREN P. DUDLEY,
Secretary of Civil Service Commissioners.

Due notice was given that the foregoing Civil Service Rules would go into operation on the first day of March, A.D. 1890.

AMENDMENTS TO THE RULES.*

AMENDMENTS TO THE CIVIL SERVICE RULES, PREPARED BY THE
CIVIL SERVICE COMMISSIONERS UNDER THE AUTHORITY OF CHAPTER
320 OF THE ACTS OF 1884.

Rule VI. is hereby amended by adding to and including in
Schedule B the following class:—

“CLASS 9. All members of the regular or permanent fire force
of any city, except Boston, after the mayor and aldermen of such
city shall have requested the commissioners to include such force
in the classified service.”

Clause e of section 2 of Rule X. is amended by adding thereto
the words “except class 9.”

The section is hereby further amended by adding the follow-
ing:—

“f. Applicants for appointment in class 9 of Schedule B shall
be not less than twenty-two nor over thirty-five years of age at
the time of making application, and shall be not less than five feet
four inches in height and weigh not less than one hundred and
twenty pounds; *provided, however,* that call men serving in the
fire department may deduct from their actual age any time not
exceeding five years during which they have continuously served
in such capacity.”

Approved by the Governor and Council Dec. 14, 1892.

Attest: WARREN P. DUDLEY,
Secretary of Civil Service Commissioners.

* Due notice was given that these amendments to the Civil Service Rules would
go into operation on the first day of March, A.D. 1893.

AMENDMENTS TO THE RULES.*

AMENDMENTS TO THE CIVIL SERVICE RULES, PREPARED BY THE CIVIL SERVICE COMMISSIONERS PURSUANT TO THE AUTHORITY CONFERRED BY SECTION 2 OF CHAPTER 320 OF THE ACTS OF THE LEGISLATURE OF 1884, AND SECTION 1 OF CHAPTER 253 OF THE ACTS OF THE LEGISLATURE OF 1893.

Rule VI. is hereby amended by adding to and including in Schedule B the following class:—

“CLASS 10. All truant officers in the city of Boston.”

Section 2 of Rule X. is hereby amended by adding thereto the following:—

“g. Applicants for appointment in class 10 of Schedule B shall be not less than thirty nor over forty-five years of age at the time of making application.”

Clause e of section 2 of Rule X. is hereby amended by adding thereto the words “and class 10.”

Approved by the Governor and Council Aug. 16, 1893.

Attest: WARREN P. DUDLEY,
Secretary of Civil Service Commissioners.

* Due notice was given that these amendments to the Civil Service Rules would go into operation on the first day of November, A.D. 1893.

AMENDMENTS TO THE RULES.*

AMENDMENTS TO THE CIVIL SERVICE RULES, PREPARED BY THE
CIVIL SERVICE COMMISSIONERS PURSUANT TO THE AUTHORITY
CONFERRED BY SECTION 2 OF CHAPTER 320 OF THE ACTS OF
THE LEGISLATURE OF 1884.

1. Section 2 of Rule VI. is hereby amended by inserting after the word "cities," in the fourth line thereof, the following: "whether paid by time for work done, or by the piece, or in any other way."

2. Section 3 of Rule VI. is hereby amended by striking out class 3 and substituting therefor the following:—

"CLASS 3. a. The detective force of the district police.

"b. The inspection force of the district police.

"c. The regular police force and all persons doing permanent police duty in and for and paid by any city of the Commonwealth, except the city of Boston.

"d. The special, substitute or supernumerary police force and all persons doing temporary police duty in and for and paid by any city of the Commonwealth, except the city of Boston."

3. Section 3 of Rule VI. is hereby further amended by striking out class 5 and substituting therefor the following:—

"CLASS 5. Engineers and assistant engineers, draw-tenders and assistant draw-tenders, employed on bridges in the cities of the Commonwealth."

4. Section 3 of Rule VI. is hereby further amended by adding to and including in Schedule B thereunder the following class:—

"CLASS 11. Engineers, janitors and persons having charge of public school buildings heated by other means than direct furnace or stove heat, in any city except Boston, after the school committee of such city shall have requested the commissioners to include such force in the classified service."

* Due notice was given that these amendments to the Civil Service Rules would go into operation on the first day of October, A.D. 1894.

5. Section 1 of Rule X. is hereby amended by adding thereto the following: "except that female applicants must be not less than eighteen years of age at the time of filing the application."

6. Clause *a* of section 2 of Rule X. is hereby amended by adding thereto the following: "except that applicants for appointment in the State Prison and Massachusetts Reformatory shall be not less than five feet seven inches in height and weigh not less than one hundred and thirty-five pounds."

7. Clause *b* of section 2 of Rule X. is hereby amended by striking out the word "six," in the fourth line, and inserting in place thereof the word "seven;" and inserting after the word "thirty," in the sixth line thereof, the word "five."

8. Clause *c* of section 2 of Rule X. is hereby amended by striking out the last clause thereof, beginning with the words "In all cases in this class," and substituting therefor the following:—

"In all cases in this class, except the inspection force of the district police, applicants must be not less than five feet seven inches in height and weigh not less than one hundred and thirty-five pounds."

9. Section 2 of Rule X. is hereby further amended by adding thereto the following: "*h.* In all cases under this rule applicants shall be measured in bare feet and shall be weighed without clothing."

10. Section 2 of Rule XXII. is hereby repealed, and the following substituted therefor:—

"2. The examinations to test the physical soundness of applicants for positions in the classified service shall be made by the medical examiners, if for the Commonwealth service, and by the city physicians, or their assistants, if for city service, unless the commissioners shall appoint a physician to conduct such examinations. The results of such examinations shall be certified on blanks furnished by the commissioners."

11. Rule XXXVI. is hereby amended by striking out the first twenty-one words and inserting in place thereof the following:—

"In cases where there is no suitable eligible list and the commissioners are unable to comply with the requisition."

12. Section 2 of Rule XXXVII. is hereby repealed.

13. Rule XXXVIII. is hereby repealed and the following substituted therefor:—

"RULE XXXVIII.

"Where the compensation of any person in class 8 of Schedule B (engineers and janitors of school buildings) does not exceed three hundred dollars a year, the commissioners may, in their dis-

cretion, allow appointment to the position without examination, and no person so appointed shall receive more than said compensation, unless duly certified for appointment after examination; *provided, however*, that when a person appointed under this rule shall have served two years in the position, he may be transferred or promoted upon passing a non-competitive examination."

14. Section 1 of Rule XLI. is hereby amended by adding the words "in the first division" after the word "appointments," in the first line thereof, and by striking out the word "thirty," in the sixth line thereof, and substituting therefor the word "ten."

15. Rule XLIII. is hereby repealed and the following substituted therefor:—

" PROMOTION.

" 1. Promotions, within the several schedules and classes of the first division of the classified service, except as hereinafter provided, shall, so far as practicable, be made by successive grades, and may be by competitive or non-competitive examination; *provided, however*, that no person shall be promoted who has not passed a suitable examination under the rules, and has not served at least one year in the lower position.

" 2. Promotions in class 2 of Schedule B (fire service of Boston) may be by competitive or non-competitive examination; *provided, however*, that promotions from the call to the permanent substitute force shall be made only through competition with all applicants for said force.

" 3. Promotions in class 3 of Schedule B (police service of cities other than Boston) shall, so far as practicable, be by successive grades; *provided, however*, that no special, supernumerary substitute, reserve or temporary police officer, under whatever designation (unless a permanent reserve force in any city is established by act of the Legislature), shall be promoted to the regular or permanent force, or assigned to permanent duty, except after competition with all applicants for said force.

" 4. Promotions in class 4, Schedule B (police service of Boston), shall, so far as practicable, be by successive grades and through competitive or non-competitive examination.

" 5. Promotions in class 5, Schedule B, from assistant draw-tender to draw-tender, may be made through non-competitive examination.

" 6. Promotions in class 6 of Schedule B, from assistant or sub-foreman to foreman, may be made through non-competitive examination.

“7. Promotions in class 8 of Schedule B (janitors, etc.), except as provided in Rule XXXVIII., may be made without examination; *provided, however*, that no person shall be promoted or transferred from a position in a furnace-heated school to a steam-heated school without having passed a suitable examination in the care and handling of steam.”

16. Section 6 of Rule XLV. is hereby repealed and the following substituted therefor:—

“6. In cases of emergency, where the work of a department would suffer from delay in filling a vacancy in the labor service, as herein provided, the appointing officer may make a temporary appointment, without requisition upon the commissioners; *provided, however*, that in no case shall such temporary appointment or employment continue for more than five days, and no reappointment or employment of the same person, or of another to the same position at the end of such period, shall be allowed. And in every such case the officer making the appointment, or furnishing the employment, shall report the same to the commissioners within five days, with the reason therefor.”

17. Rule V. is hereby amended by adding thereto the following:—

“2. The words ‘city’ or ‘cities’ in the Civil Service Rules shall be construed to include and be applied to any town to which they may be applicable under chapter 267 of the Acts of 1894.”

Approved by the Governor and Council July 12, 1894.

Attest: WARREN P. DUDLEY,
Secretary of Civil Service Commissioners.

AMENDMENTS TO THE RULES.*

AMENDMENTS TO THE CIVIL SERVICE RULES, PREPARED BY THE CIVIL SERVICE COMMISSIONERS PURSUANT TO THE AUTHORITY CONFERRED BY SECTION 2 OF CHAPTER 320 OF THE ACTS OF THE LEGISLATURE OF 1884.

1. Section 3 of Rule VI. is hereby amended by adding in class 9, after the words "any city except Boston," the words "and of any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894;" and after the words "mayor or aldermen of such city," the words "or the selectmen of such town;" so that the article as amended shall read as follows:—

"CLASS 9. All members of the regular or permanent fire force of any city except Boston, and of any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894, after the mayor and aldermen of such city or the selectmen of such town shall have requested the commissioners to include such force in the classified service."

2. Section 3 of Rule VI. is further amended by adding in class 11, after the words "any city except Boston," the words "and in any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894;" and after the words "of such city," the words "or town;" so that the article as amended shall read as follows:—

"CLASS 11. Engineers, janitors and persons having charge of public school buildings heated by other means than direct furnace or stove heat, in any city except Boston, and in any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894, after the school committee of such city or town shall have requested the commissioners to include such force in the classified service."

* Due notice was given that these amendments to the civil service rules would go into operation on the first day of May, A.D. 1895.

3. Rule XLIV. is hereby amended so as to read as follows:—

“RULE XLIV.

“Under the second division of the civil service there shall be two schedules, to be known as Schedule C and Schedule D. Schedule C shall include all male laborers and mechanics in the employ of the city of Boston, to be designated as the labor service of the city of Boston. Schedule D shall include all male laborers and mechanics in the employ of each of the other cities of the Commonwealth, or of any town accepting the provisions of chapter 267 of the Acts of the Legislature of 1894, to be designated as the labor service of such city or town. The commissioners may from time to time provide for the registration and certification of such employees in any of said cities or towns; and they may, in their discretion, discontinue such registration and certification in any of said cities or towns whenever such city or town shall fail to appropriate such sum of money as, in their opinion, is necessary to provide for the full enforcement of all rules and regulations relating to the labor service of such city or town. Notice of their action in each case shall be certified to the mayor of such city or the selectmen of such town, and shall be published in one or more newspapers therein.”

Approved by the Governor and Council Jan. 30, 1895.

Attest: WARREN P. DUDLEY,
Secretary of Civil Service Commissioners.

AMENDMENTS TO THE RULES.*

AMENDMENTS TO THE CIVIL SERVICE RULES, PREPARED BY THE CIVIL SERVICE COMMISSIONERS PURSUANT TO THE AUTHORITY CONFERRED BY SECTION 2 OF CHAPTER 320 OF THE ACTS OF THE LEGISLATURE FOR 1884.

First. Section 2 of Rule VI. is hereby repealed and the following substituted therefor:—

“2. Schedule A shall include the following classes:—

“CLASS 1. Clerks and other persons, under whatever designation, rendering services as copyists, recorders, book-keepers, agents or any clerical, recording or similar service in the Commonwealth or the several cities, whether paid by time for work done, or by the piece, or in any other way, whose annual compensation is at a rate of less than eight hundred dollars.

“CLASS 2. Persons occupying similar positions as those included in class one, whose annual compensation is at a rate of eight hundred dollars and over.

“CLASS 3. Inspectors, agents, almoners and all persons, under whatever designation, whose duties may be in part clerical.

“CLASS 4. Stenographers and typewriters.

“CLASS 5. Messengers, and all persons under whatever designation performing messenger service, either permanently or temporarily, in any city of the Commonwealth, not included in any of the above classes under this schedule; *provided, however,* one messenger of the mayor in each city is excepted herefrom.”

Second. Section 3 of Rule VI. is hereby amended by adding to and including in Schedule B thereunder the following classes:—

“CLASS 12. Superintendents, assistant superintendents, deputies and other persons, under whatever designation, performing any of the duties of a superintendent in any city of the Commonwealth or in any town of the Commonwealth accepting the provisions of chapter 267 of the Acts of 1894, excepting so far as the same are exempted by statute.

* Due notice was given that these amendments to the Civil Service Rules would go into operation on the fifteenth day of February, A.D. 1897.

“**CLASS 13.** Civil engineers, draughtsmen, transitmen, levellers, chainmen, rodmen and all assistants, under whatever designation, except laborers, employed in any city of the Commonwealth or in any town accepting the provisions of chapter 267 of the Acts of 1894.

“**CLASS 14.** The aids and other persons, under whatever designation, employed in detective service in the office of the State Fire Marshal.”

Third. Clause *b* of section 2 of Rule X. is hereby amended by striking out the word “seven” and substituting therefor the word “five.”

Fourth. Section 1 of Civil Service Rule XII. is hereby repealed, and in place thereof the following is substituted: —

“**SECTION 1.** The word ‘veteran’ in these rules shall mean a person who served in the army or navy of the United States in the time of the war of the rebellion and was honorably discharged therefrom; and also a citizen of Massachusetts who has distinguished himself by gallant and heroic conduct while serving in the army or navy of the United States, and has received a medal of honor from the President of the United States.”

Fifth. Section 2 of said Rule XII. is hereby amended by striking out the words “under chapter 437 of the Acts of 1887.”

Sixth. Section 2 of Rule XXIV. is hereby amended by striking out the words “Every applicant under chapter 437 of the Acts of 1887,” and substituting therefor the words “Every veteran applying for appointment without examination.”

Seventh. Rule XXVII. is hereby repealed, and the following rule is substituted therefor: —

“**RULE XXVII.** 1. Whenever any officer or board having the power of appointment to any office or employment under these rules shall make requisition, not expressly calling for women, the commissioners shall certify the names of all veterans who have passed the examination for the position sought in the order of the respective standing of such veterans upon the list; and in case there is no such veteran upon the list, then the commissioners shall certify the names of the three most eligible persons, not veterans, upon the list. In case such officer or board shall in the requisition request the certification of women, then the commissioners shall certify the names of the three women standing highest upon the eligible list.

“2. The appointment or employment shall be made from the list of names so certified, subject to the provisions of the following section.

“3. Whenever any officer or board having the power of appointment to any office or employment shall in his requisition so request, the names of any or all veterans registered under Rule XII. shall be certified, and any of the veterans so certified may be appointed or employed in the office or position sought.”

Eighth. Civil Service Rule XXX. is hereby repealed.

Ninth. Sections 1 and 2 of Civil Service Rule XXXV. are hereby repealed.

Tenth. Rule XXXVIII. is hereby amended by adding the following section thereto:—

“2. When the compensation of any person in class 5 of Schedule A (messengers in cities) does not exceed four hundred dollars per year, the commissioners may, in their discretion, allow appointment to the position without examination; *provided, however*, that no person so appointed, or who may be employed as a messenger when this rule shall take effect, shall be transferred or promoted to any position in the classified service, except that a messenger so appointed or employed without examination may, after two years of continuous service as such, be promoted or transferred upon passing a non-competitive examination.”

Eleventh. Section 1 of Rule XL. is hereby amended by adding thereto the words “immediately upon the expiration of his term of office.”

Twelfth. Section 2 of said rule is hereby amended by striking out the words “after due certification for the same under these rules,” and by striking out the words “one year,” and substituting therefor the words “six months.”

Thirteenth. Rule XLV. is hereby repealed, and the following rule substituted therefor:—

“RULE XLV. 1. Every applicant for labor, who produces satisfactory evidence of his capacity for labor and his habits as to industry and sobriety, shall be registered in the order of his application, at such convenient times and place or places as shall be designated by the commissioners. He shall state under oath the (1) name, (2) age, (3) residence, (4) citizenship, (5) number and relationship of persons depending for support upon the applicant, (6) service in the army or navy in time of war, (7) previous occupation, (8) references, (9) personal description, and such other information as may be required.

“2. Every applicant shall file a certificate, signed by two reputable citizens, to the effect that he is qualified to perform the labor sought. Every applicant claiming preference as a veteran shall also produce satisfactory evidence of his service in the army

or navy of the United States in the time of the war of the rebellion and his honorable discharge therefrom.

“ 3. No certificate from an appointing officer in regard to the capacity of a mechanic or laborer applying for registration shall be received, unless the mechanic or laborer has worked in the department and the appointing officer has an official knowledge of his capacity.

“ 4. The commissioners may in their discretion provide and require examination regarding the physical qualifications of any applicant. No applicant shall be registered unless he appears to be qualified therefor.

“ 5. When the services of laborers are required, the appointing officer or board shall notify the commissioners, stating the number of men wanted, the precise nature of the labor in which they are to be employed and the time and place of employment. The commissioners shall thereupon certify the names with the residences of veterans registered and qualified for the required labor. In case there is not a sufficient number of veterans so registered and qualified for the required labor, the commissioners shall certify twice the number of men called for, over and above the number of veterans, if any, certified, making an impartial selection, giving preference, *first*, to those who have had experience in the department, and, *second*, to those having families dependent upon them for support.

“ 6. In case the appointing officer or board shall in the requisition certify that the labor to be performed is so arduous as to require the services of young and vigorous men, and shall designate a maximum age limit, the commissioners may recognize such age limit, if satisfied of the truth of the certificate.

“ 7. The selection shall be made from the list so furnished, and the names of those employed shall be returned to the commissioners forthwith. At the end of their term of service, the persons so employed may keep their places on the register, upon application to the commissioners and proof that their labor has been satisfactory.

“ 8. In case the commissioners are unable to fill a requisition for laborers, the fact shall be certified to the officer making the requisition, who shall then make the selection, under such regulations as the commissioners may from time to time prescribe.

“ 9. In cases of emergency where the labor of a department would suffer from delay in filling a vacancy in the labor service, as herein provided, the appointing officer may make a temporary appointment without requisition upon the commissioners; *pro-*

vided, however, that in no case shall such temporary appointment or employment continue for more than five days, and no reappointment or employment of the same person or of another to the same position at the end of such period shall be allowed. And in every such case the officer making the appointment or furnishing the employment shall report the same to the commissioners within five days, with the reason therefor.

“ 10. Any mechanic or laborer suspended and not actually employed in the department in which he is enrolled shall at the end of six months be deemed to be out of the service and shall not be thereafter employed, except after registration and certification by the commissioners; and the appointing officer shall forthwith report to the commissioners the name of any mechanic or laborer so suspended; *provided, however*, that this provision shall not apply to veterans.

“ 11. No mechanic or laborer shall be employed in labor other than that for which he is certified, until after such person shall have been continuously employed in the same labor in the same department for which he was certified for at least two months; *provided, however*, that this provision shall not apply to veterans.

“ 12. Any mechanic or laborer who shall be found or certified to the commissioners by the appointing officer to have been dismissed from the service without fault or delinquency on his part may be reinstated in such service in the same department within three months next following such dismissal.”

Approved by the Governor and Council Dec. 3, 1896.

Attest: WARREN P. DUDLEY,
Secretary of Civil Service Commissioners.

GENERAL REGULATIONS

ADOPTED BY THE

CIVIL SERVICE COMMISSIONERS.

THE CHIEF EXAMINER.

1. The chief examiner shall, so far as practicable, attend the examinations held by the several boards of examiners.

He shall take care to secure accuracy, uniformity and justice in the proceedings of all examiners and boards of examiners under the rules and regulations; and such proceedings and all papers appertaining thereto shall at all times be open to him. He shall also, from time to time, inspect the proceedings and papers connected with examinations under the civil service rules, and shall make report of such inspection to the commissioners.

2. He shall prepare and submit to the commissioners proper schemes for examinations, and forms for blanks and records.

He shall take care that the rules and regulations are complied with, and shall bring any case of their infraction, or of injustice or irregularity, observed by him, to the attention of the commissioners. It shall be his duty, from time to time, to confer with the heads of departments, offices and institutions of the Commonwealth, and the several cities thereof, concerning the regularity, sufficiency and convenience of the examinations for the service under them. He shall perform such other appropriate duties as may be specified in these regulations, or otherwise assigned to him by the commissioners.

THE SECRETARY.

3. The secretary shall keep the records of the proceedings of the commissioners, and have charge of, and be responsible for, the safe keeping of the books, records, papers and other property in their office. He shall make such certification as the commissioners may direct of those eligible for appointment or employment. He shall generally conduct the correspondence of the commissioners, and perform such other appropriate duties as they may assign to him.

EXAMINERS.

4. Regular boards of examiners shall consist of not less than three nor more than five members, one of whom shall act as secretary; and a majority of any board may conduct an examination in the absence of the other members. The secretary of each board shall keep a complete record of its proceedings, and of all the examinations held by it, in such form as the commissioners may prescribe.

5. The board of examiners for each city shall promptly notify the commissioners of the need of holding an examination in and for such city; and thereupon the chief examiner shall, under the direction of the commissioners, issue authority therefor, and shall prepare questions and supervise the other preliminary arrangements.

6. The boards of examiners shall conduct the examinations, and estimate and mark the standing of the persons examined, or in a non-competitive examination shall mark the qualifications of the person examined.

7. Special boards will be selected, and special regulations for examinations will be issued by the commissioners when expedient.

8. No examiner or person serving under the commissioners shall attempt to influence the selection of any person for the civil service.

9. The examiners shall preserve order and decorum at examinations, and prevent any interference, by conversation or otherwise, with those under examination.

10. Each examiner will exercise diligence in securing fairness and preventing collusion and fraud in the examinations.

11. No examiner shall disclose, unless by consent of those examined, the results of the examination.

12. Any person, after receiving official notification of his standing, as ascertained by a competitive examination, may, in person or by duly authorized agent, inspect his examination papers.

13. Complaints of any injustice or unfairness on the part of any examiner or examining board, or by any one acting under the commissioners, may be made in writing to the commissioners, who will act as substantial justice in the premises may require.

14. Each examiner shall be entitled to receive from the appropriation for the expenses of administering the civil service law twenty cents for each applicant whose examination he shall attend, and twenty cents additional for each set of examination papers he

shall mark ; the total number of papers prepared by one applicant being considered a set. For the additional service rendered by the secretary of each board of examiners of cities other than Boston, in registering the eligibles, certifying the same, conducting necessary correspondence, and in other ways, he shall be entitled to receive from the same appropriation the additional sum of twenty-five cents for each eligible so registered. [3, 24, '93.]

15. No person shall act as examiner in any examination of applicants for admission to the classified civil service, when he is an applicant or an eligible for a position in the class for which the examination is being held. [12, 21, '94.]

COMPETITIVE EXAMINATIONS.

16. Applicants must present themselves punctually at the times and places specified in their official notices to attend, and they will be admitted to examination upon the production of such notices.

17. Each applicant in a competitive examination shall first be presented with a declaration paper, on which he will write his name, age, residence, examination number, etc., after which he will place it in an envelope, seal the envelope, and thereafter he shall mark each paper with his examination number only. The envelope shall not be opened until after all his examination papers are marked.

18. The sheets of questions will be numbered, and will be given out in the order of their numbers, each after the first being given only when the competitor has returned to the examiners the last sheet given to him. In general, no examination shall extend beyond five hours. Each applicant must complete his examination on the obligatory subjects before taking up any of the optional subjects.

19. The subjects of, and the time allowed for, the examination, will be announced before the first paper is given out.

20. Applicants for appointment in classes 2 and 4, Schedule B (the fire and police departments of the city of Boston), shall be examined by the city physician to test their physical soundness, and no one who fails to pass such examination shall be eligible for appointment.

Each applicant who shall have passed such examination, and also the educational examination, shall be required to undergo such further physical examination as the commissioners may from time to time prescribe, adapted to ascertain his special fitness for the service for which he has applied.

Such examination shall be made by a physical examiner, to be

appointed by the commissioners, and shall be recorded upon blanks provided for the purpose, upon which each required qualification shall be entered, and shall be marked with the percentage of excellence which the several applicants shall respectively be found to possess.

The percentage of each qualification shall be multiplied by the weight prescribed for each by the commissioners; and the quotient found by the division of the aggregate of value so arrived at, of each applicant, by the aggregate of weights shall constitute the percentage of condition of such applicant.

When an applicant for police or fire service in Boston fails to obtain sixty-five per cent. in either strength tests or development, he shall not be re-examined in those subjects until after he has filed a new application and undergone another examination as a new applicant. [1, 9, '91.]

To determine the standing of applicants for appointment in Class 4, Schedule B (the police force of Boston), equal weight shall be given to the physical and educational examinations; in Class 2, Schedule B (the fire force of Boston), the comparative weight to be given to each of such examinations shall be three to two. [1, 30, '94.]

21. Applicants for fire service in Boston, who have passed the examination and are on the eligible list for appointment to the permanent substitute force, may be certified for appointment to the call force upon the percentage obtained in their educational examination: *provided, however*, that such certification, or appointment in the call force, shall not affect their standing on the eligible list for the permanent substitute force.

22. Applicants for positions as watchmen and turnkeys in the State Prison and Massachusetts Reformatory shall undergo such physical examination by one of the medical examiners of the Commonwealth as may be from time to time prescribed by the commissioners.

NON-COMPETITIVE EXAMINATIONS.

23. In cases where a non-competitive examination may be needed, either to test the capacity of applicants for any part of the service which requires peculiar information or skill, or to fill a position for which there are no suitable candidates on the eligible list, or for promotion, or temporary appointment, or otherwise, the commissioners will provide for such examination.

24. Applicants for non-competitive examinations shall fill out and make oath to the proper application paper (without certificates); but any person named by the appointing power for non-

competitive examination may file such paper at any time before undergoing the examination.

25. The non-competitive examination shall conform, as nearly as practicable, in subject, questions and marking, to the competitive examination of the same grade.

26. Non-competitive examinations shall, in the absence of any special regulations to the contrary, be conducted by the chief examiner, and the papers marked by him with the assistance of such person as he may select.

SPECIAL EXAMINATIONS.

27. Applications for any special examination must be made in the form prescribed by the commissioners, and must be accompanied by certificates, as required in cases of ordinary applications.

28. Whenever a special examination is to be held, proper notice shall be given by advertisement or otherwise.

29. Each special examination shall embrace the subjects approved by the commissioners, after consultation with the head of the office concerned, or the special examining board for such office; and shall, so far as appropriate, be conducted under the general regulations, as to the marking of examination papers and the grading of persons examined.

30. A special record of applicants, and a special register of eligible persons, shall be kept for each part of the service, or office requiring special examinations; and when the commissioners or the proper examining board shall be notified by the appointing officer of a vacancy in such part of the service, certification shall be made to him of the names of the three persons graded highest on the special list of persons eligible for the same.

31. In case competent special applicants do not apply, after suitable notice, the appointing officer may be authorized to select a person for non-competitive examination.

MARKING.

32. Each examination paper shall be reviewed by a majority of the examiners conducting the examination; and, in any case of disagreement, the average of the markings made on any question or paper by all shall be the final marking on such question or paper.

33. The papers in each subject shall, whenever practicable, be examined, compared and marked before the papers in another subject are examined.

34. The marking of each question or subject shall be made on a scale of 100, which shall represent entire accuracy; and 0 shall represent entire ignorance. Handwriting will be judged by its legibility, uniform and correct formation of letters and ease of execution. Upon a comparison of the handwriting of all, the best and worst should be first determined, and the two extremes of the scale thus fixed; the others should be marked relatively to them. In writing from dictation or copying from manuscript, the omission, repetition or substitution of words, the erasures, blots and other evidences of carelessness, will reduce the marking below 100. Abstracts or summaries of documents, and letter-writing, will be marked as in handwriting, by determining the best and worst examples; and the examiners, having marked these, will then mark the others proportionately.

35. In each of the other subjects, each question shall be marked on a scale of 100; and the sum of such markings, divided by the number of questions in that subject, shall determine the standing on such subject.

36. In marking the examination papers of applicants for police, prison and fire service, orthography shall not be marked as a subject to which a special weight is attached; but errors in orthography shall be taken into account in marking the exercises in copying, letter-writing and reporting.

37. The following examples show the method by which the standing of each competitor is obtained. The weights here given to the different subjects are not to be regarded as the standard weights; these, and also the subjects, will be varied to meet the requirements of the position to be filled.

EXAMINATION OF _____

(For a position in Class 1, Schedule A.)

SUBJECTS.	Standing on Subjects.	Weight given to Subjects.	Product of Weight and Standing.
Penmanship,	80	4	320
Dictation,	75	2	150
Copying rough draft,	70	3	210
Orthography,	85	1	85
Arithmetic,	82	3	246
Composition,	70	2	140
	—	15	1,151
General average standing,	—	—	76.78

EXAMINATION OF _____

(For a position in Class 2, Schedule A.)

SUBJECTS.	Standing on Subjects.	Weight given to Subjects.	Product of Weight and Standing.
Penmanship,	85	4	340
Dictation,	90	2	180
Copying rough draft,	96	3	288
Orthography,	100	1	100
Arithmetic,	80	3	240
Interest and discount,	75	2	150
	-	15	1,298
General average standing,	-	-	86.53

EXAMINATION OF _____

(For a position in Schedule B.)

SUBJECTS.	Standing on Subjects.	Weight given to Subjects.	Product of Weight and Standing.
Penmanship,	70	2	140
Copying,	80	2	160
Clearness and correctness of statement,	75	3	225
Experience,	80	3	240
Arithmetic,	70	2	140
Local data; duties,	70	3	210
	-	15	1,115
Educational qualifications,	-	-	74.33
Physical qualifications,	-	-	85.
	-	2	159.33
General average standing,	-	-	79.66

It will be observed that the standing on each subject is multiplied by the weight given that subject, and the product placed in the third column; the sum of these products, divided by the sum of the weights, gives the general average standing.

ELIGIBLE LIST.

38. The names of those found eligible shall be enrolled upon a register in form prescribed by the commissioners.

39. Priority of date in examination will give no advantage in position on the eligible list.

40. The names of persons placed on the eligible list in Class 2 of Schedule A (the higher clerical service) may also, upon request in writing, be placed on the eligible list for positions in Class 1 of Schedule A, with the same standing.

41. Persons whose names are on the eligible list for the prison service of a city may, upon request in writing, have their examination papers marked by the State Board of Examiners; and, if they are found qualified, their names may be placed on the eligible list for the prison service of the Commonwealth. Persons whose names are on the eligible list for the prison service of the Commonwealth, who have been residents of the city in which they reside for six months, may, upon request in writing, have their examination papers marked by the board of examiners for the city in which they reside; and, if they are found qualified, their names may be placed on the eligible list for the prison service of said city.

42. Persons whose names have been on an eligible list one year may, upon request in writing, and satisfactory evidence in regard to health and other qualifications, be continued upon the eligible list without further examination for a second year.

CERTIFICATION.

43. In all cases of certification, the appointing officer is entitled to three names. He can make requisition to fill each vacancy, and receive three names; or, for his own convenience, unless otherwise ordered in any particular case by the commissioners, in cases where more than one vacancy exists, he can, in one requisition, call for names to fill all the vacancies. In that case he will receive together the names he would have received in separate certifications. As no person under the rules is entitled to certification more than three times except by consent of the appointing power, this porportion shall be as follows: For one vacancy, three names shall be certified; for two vacancies, four names; for three vacancies, five names; then for each multiple of three vacancies, the same multiple of five names; for one vacancy over a multiple of three, three names additional to those prescribed for such multiple; for two vacancies over a multiple of

three, four names in addition to those prescribed for such multiple.
For example : —

For 1 vacancy certify 3 names.

2 vacancies	"	4	"
3	"	5	"
4	"	8	"
5	"	9	"
6	"	10	"
7	"	13	"
8	"	14	"
9	"	15	"
10	"	18	"

For 11 vacancies certify 19 names.

12	"	"	20	"
13	"	"	23	"
14	"	"	24	"
15	"	"	25	"
16	"	"	28	"
17	"	"	29	"
18	"	"	30	"
19	"	"	33	"
20	"	"	34	"

44. Whenever an officer, who shall have made a requisition to fill a certain number of vacancies, shall appoint to office a smaller number than that of the vacancies named by him, he shall not make the selection therefor from the whole number certified to him, but only from that number of names standing highest upon said list that would have been certified to him had the requisition stated the number of vacancies which he actually filled. In case of doubt what that number would be, he will apply to the commissioners for information before making selection.

45. No one who may be examined upon any subject of a technical or special character, in addition to the general or limited examination, shall be entitled to be certified for appointment, if his standing in such subject shall be less than sixty-five per centum of complete proficiency.

46. All the applicants for promotion in the Boston police force who pass the regular examination in penmanship, orthography, composition, arithmetic and the duties of the office, shall be certified to the Board of Police. Those who served in the military or naval forces of the United States in time of war, and received an honorable discharge therefrom, shall be indicated; and such persons shall be preferred for appointment.

47. In case a person upon any register shall, by reason of ill-health or physical incapacity, in the judgment of the commissioners, become manifestly disqualified for the service for which he or she is registered, the commissioners may direct that such person be not certified; and the commissioners must be informed by the proper examining boards of each case of such disqualification.

48. The applicant affected by such suspension, or refusal of an examination, may make complaint in writing to the commissioners, who will take proper action thereon.

GENERAL PROVISIONS.

49. In case any applicant makes any false statement for the purpose of securing an examination or preference, or has been guilty of bad faith or fraud, and in case *prima facie* evidence shall be presented to the board of examiners that any person on a record or register is, by reason of bad character or dissolute habits, or any criminal or disgraceful act committed by him, or of his dismissal for good cause from the public service, not a fit person to be examined, marked or certified, it will be the duty of the board to report upon the matter fully and promptly to the commissioners; and the marking, grading or certification of such person shall be suspended, pending the action of the commissioners upon the subject. Upon such report to the commissioners or the production of any other evidence, the commissioners will make the proper investigation and give appropriate direction to the board of examiners.

50. The commissioners cannot advise persons as to vacancies in the service, nor furnish any information as to the duties, salaries, course of promotion, or other conditions of positions and offices, except such as may be found in printed regulations. No advice can be given as to the course of preparation that applicants should follow, nor can specimens of the examination papers be furnished.

51. Every application paper and accompanying certificates will remain on file in the office of the commissioners or boards of examiners, and under no circumstances or conditions will the originals be returned to the applicant.

SPECIAL REGULATIONS

IN RELATION TO THE

EMPLOYMENT OF LABORERS AND MECHANICS.

1. Men who seek employment as laborers or mechanics shall apply for registration at the civil service labor office, in their respective cities, at such times as may be designated by the commissioners. When the applicants for work as common laborers, or as skilled laborers or specialists, are, in the opinion of the commissioners, sufficient to meet all probable demands for a period of six months or more, registration of the class for which the supply is sufficient shall cease, except in the case of persons who have served in the army or navy of the United States in time of war, and received an honorable discharge therefrom, and who produce the requisite certificates as to character and capacity.

2. No applicant for the labor service who may have acquired, by reason of previous registration or previous service, the right to register in the second division of the classified service at the time when the eligible list is closed to general registration, shall retain such right unexercised for a longer period than two years, except by vote of the commissioners.

3. Laborers employed as boys, and receiving boys' pay, who have served as such two years, may, at the request of the head of the department in which they have served, be allowed to register at any time as laborers in the classified service.

4. Each applicant must produce a certificate, signed by two reputable citizens of his city, of his capacity for labor and his habits as to industry and sobriety: *provided, however*, that in the case of a person honorably discharged from the services of the city, a certificate by the officer under whom he served, of his capacity and good conduct, may be accepted, in the absence of evidence to the contrary, as sufficient. When the applicant desires to be registered for any other service than that of a common

laborer, he will be required to produce a certificate, from some competent person or persons, of his ability to do the special kind of work for which he alleges capacity, and for which he desires to be certified.

5. The registration clerk shall require each applicant to state, under oath, his name, residence, citizenship, age, and number of persons depending upon him for support; his services, if any, in the army or navy in time of war; his present employment and past occupation; and such other facts as the commissioners may deem necessary to show his capacity for labor and his habits as to industry and sobriety.

6. The clerk shall append to each statement a brief personal description of the applicant, and any notes that may serve to show his capacity for the service sought. Where the applicant appears to possess very superior physical qualifications, the fact will be noted. [12, 24, '96.]

7. Before entering the name of an applicant on the register, such further inquiry may be made in regard to his character and capacity as the commissioners may deem practicable or expedient.

8. When it shall appear from the evidence presented that an applicant is capable and of temperate and industrious habits, the clerk shall place his name on the register.

9. In case an applicant, who has made a sworn statement as hereinbefore provided, is found to be unfit or in any way disqualified to perform the service which he seeks, his name shall not be entered on the register, and the reason therefor shall be endorsed on the applicant's statement.

10. When the services of laborers are required in any department to which the rules apply, the head of the department, or other officer thereto duly authorized, shall make a requisition upon the commissioners for the number of laborers wanted, specifying the kind of service for which they are wanted.

11. Upon the receipt of such requisition, the clerk, under the direction of the commissioners, shall send to the officer making the requisition double the number of names called for, if the register contains so many, stating the following particulars in regard to each; namely, registration number, name, residence, age, number in family, service in army or navy in time of war, kind of labor for which he alleges capacity, and such other information as the commissioners may direct. [12, 24, '96.]

12. In filling requisitions for laborers and mechanics, preference will be given to veterans, and, other things being equal, to

those on the register who have had experience in city work, and those having families depending upon them for support. When the service calls for men possessing superior physical qualifications, the officer making the requisition will so state; and the selection will, so far as practicable, be made from those marked at the time of registration as possessing such qualifications.

13. Whenever the commissioners shall be unable to fill a requisition for laborers, and shall certify such fact to the officer making the requisition, and permit him to make the selection himself, the laborers so selected shall present themselves at the civil service labor office, in their city, for registration in the manner and under the condition prescribed for those seeking employment, as set forth in special regulations in relation to the employment of laborers: *provided*, that the commissioners may suspend this regulation in emergencies, when, in their opinion, the good of the service shall require such action.

14. Whenever an officer, who shall have made a requisition for a certain number of laborers, shall employ a smaller number, he shall not make the selection therefor from the whole list certified to him, but only from the number of names standing first upon said list double the number he shall actually employ.

15. When the head of the department or other officer has selected and employed such of the persons named on said list as he may require, he shall forthwith return to the commissioners' office a list of the persons so selected, stating the kind of work for which they have been employed. In case any of the persons certified fail to respond to the call of the head of the department or other officer, or decline the employment offered, or withdraw from the service without good cause, the registered numbers of such persons shall be returned to the commissioners with a statement of the facts; and the names of such persons shall be taken from the register, unless a satisfactory explanation of the failure or refusal to work is given.

16. When a laborer in any of the departments coming within the rules is discharged or dropped from the pay-rolls, a certificate of the fact shall be sent to the commissioners, on a form provided therefor, stating the name of the person, his registration number, the date of his employment, the kind of work on which he was employed, the date of his discharge, the cause and whether his conduct and work have been satisfactory.

17. If the person so discharged or dropped desires to have his name restored to the register, he can apply at the registration office; and, if it appears that his conduct and work have been

satisfactory, and that he is a man of good habits and able-bodied, it will be done.

18. When a person is discharged from the labor service for "loitering," "incompetence," "unsatisfactory work," or any equivalent cause, unless the charge is disproved, he shall not be eligible for registration again for a period of at least six months from the date of such discharge. At the end of that time he can apply for registration on the same basis as other citizens; and, in case he is registered, he shall not be eligible to certification to the department from which he was discharged except with the written consent of the head of that department. When a person is discharged from said service for "intoxication," and the charge is not disproved, he shall not be eligible for registration again for a period of at least a year from the date of such discharge; and his registration then will be subject to the conditions hereinbefore prescribed for men discharged for "incompetency," etc. In case a person is discharged a second time for any of the causes named, he shall not be eligible for registration again, except by special vote of the commissioners.

CIVIL SERVICE COMMISSIONERS.

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ARTHUR LORD, PLYMOUTH.

EDWARD P. WILBUR, BOSTON.

Chief Examiner.

HENRY SHERWIN, JAMAICA PLAIN.

Secretary.

WARREN P. DUDLEY, CAMBRIDGE.

*Office of Civil Service Commissioners, Rooms 151, 152, State House,
Boston.*

Registrar of Labor, — Labor Office, State House, Boston.

WILLIAM L. HICKS.

Registration Clerk, — Labor Office, City Hall, Cambridge.

HARRY L. LINCOLN.

Registration Clerk, — Labor Office, Library Building, New Bedford.

RUFUS H. WILLIS.

Registration Clerk, — Labor Office, City Hall, Newton.

THEODORE A. FLEU.

Registration Clerk, — Labor Office, City Hall, Everett.

GEORGE H. BURR.

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CHARLES A. LEGG, *Examiner in Electrical Engineering.*

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EXAMINERS — *Concluded.*

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EDWARD J. GREGORY.

For the City of Worcester.

FRANK B. HALL, *Secretary.*

JAMES EARLY.

APPLICATION PAPER.

QUALIFICATIONS.

Applicants must be citizens of the United States who have resided in the Commonwealth for one year next preceding the date of their application, and, if they apply for appointment in the service of a city, they must have resided in such city for six months next preceding the date of their application.

In Schedule A there is no requirement as to age, height and weight, except that female applicants must be not less than eighteen years of age.

In Schedule B there are the following requirements as to age, height and weight: (a.) In class 1 (the prison service) there is no requirement as to age, height and weight, except that applicants for positions in the State Prison and Massachusetts Reformatory must be not less than five feet seven inches in height in bare feet and weigh not less than one hundred and thirty-five pounds without clothing. (b.) In class 2 applicants for appointment to the fire force of Boston must be not less than twenty-two nor over thirty years of age at the time of filing the application, and must be not less than five feet five inches in height in bare feet and weigh not less than one hundred and thirty-five pounds without clothing: *provided, however*, that applicants for appointment to the call force of the fire department of Boston, who are serving as call substitutes in said department, may, for the purpose of making themselves eligible under the rules for examination, deduct from their actual age any time not exceeding five years during which they have served in such capacity; and *provided, further*, that applications for appointment as permanent substitutes may be made by persons serving in the call force who are under forty years of age. (c.) In class 3 applicants for appointment to the police force of any city other than Boston must be not less than twenty-two nor over forty years of age, and applicants for appointment to the district police force must be not less than twenty-two nor over fifty-five years of age at the time of filing the application: *provided, however*, that this limitation as to age shall not apply to persons who served in the army or navy of the United States in time of war, and have been honorably discharged therefrom. In all cases in this class, except the inspection force of the district police, applicants must be not less than five feet seven inches in height in bare feet and weigh not less than one hundred and thirty-five pounds without clothing. (d.) In class 4 applicants for appointment to the police force of Boston must be not less than twenty-five nor over thirty-three years of age at the time of filing the application, and must be not less than five feet eight inches in height in bare feet and weigh not less than one hundred and forty pounds without clothing. (e.) In class 9 persons can apply only after the mayor and aldermen of any city, except Boston, shall have requested the commissioners to include the fire force of such city in the classified service. When so included, applicants for

appointment in class 9 of Schedule B shall be not less than twenty-two nor over thirty-five years of age at the time of filing the application, and shall be not less than five feet four inches in height in bare feet and weigh not less than one hundred and twenty pounds without clothing: *provided, however*, that call men serving in the fire department may deduct from their actual age any time not exceeding five years during which they have continuously served in such capacity. (*f.*) In class 10 applicants for appointment as truant officers in the city of Boston must be not less than thirty nor over forty-five years of age at the time of filing the application. (*g.*) In all other classes in Schedule B there is no requirement as to age, height or weight.

DIRECTIONS.

1. All the statements in this application shall be made under oath or affirmation, and in the applicant's own handwriting.

2. A false statement knowingly made in this paper, or connived at in any certificate which may accompany the same, is good cause for exclusion from the eligible list or discharge during or after probation.

3. Send application, after being filled out, if for service in the departments of the Commonwealth or the city of Boston, addressed to the Civil Service Commissioners, State House, Boston, Mass. If for local service in a department of any other city, send application to the Secretary of the Board of Examiners of the city in which the service is sought.

4. No recommendations or certificates other than those provided for at the end of this blank will be received.

5. Applicants will be notified of the time and place of examination. They must give notice of any change of post-office address, or unwillingness or inability to attend the examination.

6. A failure to fill properly the blanks, or to send satisfactory certificates, will cause the application paper to be returned for correction. Applications which show that the applicants lack the qualifications as to age, health, etc., required by the rules, will be rejected, and the applicants notified.

7. The general examination is for positions in the clerical service where the annual compensation is at the rate of eight hundred dollars and over. The limited examination is for positions in the clerical service where the annual compensation is at a rate less than eight hundred dollars.

8. Every applicant for a position in the police and fire departments, and in other departments where physical capacity is of prime importance, will be required, before being placed on the eligible list, to undergo a physical examination.

9. Any person possessing the required qualifications may file a new application after the expiration of six months from his educational examination, and not earlier: *provided*, that, if his name be upon the eligible list, it shall be withdrawn therefrom upon the filing of his new application.

APPLICATION.

(Each question must be answered or the blank will be returned.)

I hereby make application to be examined for the position of _____ in the service of _____ ; [State clearly and distinctly the position or branch of service for which you wish to be examined, and whether it is in the service of the State or of a city.] and I will take the examination [See Directions, No. 7, above]

APPLICATION PAPER.

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As part of my application I declare the answers to the following questions to be true and in my own handwriting. [Sign your name in full.]

- (1) Are you married or single?
- (2) Where do you reside? [Give city or town, including street, number and ward.]
- (3) How long have you been a resident of said city or town?
- (4) How long have you been a resident of Massachusetts?
- (5) What is the date of your birth? [Give day of month and year.]
- (6) Where were you born? [Give city, town or parish, State and country.]
- (7) Are you a citizen of the United States? . [If you are a naturalized citizen, or if your parents were naturalized during your minority, give date, place and court of naturalization.]
- (8) What is your father's full name? [Give name, whether living or dead.]
- (9) What is your mother's full name? [Give name, whether living or dead.]
- (10) Are you a person of good moral character?
- (11) Do you habitually use intoxicating beverages to excess?
- (12) Are you a vender of intoxicating liquors?
- (13) Have you ever been convicted of any offence against the laws of this or any other state or nation? [If so, give the date and state fully the nature of the offence.]
- (14) Are you in good health?
- (15) Have you any mental or physical incapacity or infirmity, of which you are aware, which would in any way disqualify you for a full discharge of official duty in the service which you seek to enter? [If you have any defect of sight, hearing, speech, or otherwise, so state.]
- (16) What is your present occupation?
- (17) What is the name and address of your employer?
- (18) Where have you lived, what has been your principal occupation and for whom have you worked during each of the last five calendar years? [Fill the blanks against each year.]

RESIDENCE, CITY OR TOWN, AND STATE.	OCCUPATION.	NAME OF EMPLOYER.
189 , ;		;
189 , ;		;
189 , ;		;
189 , ;		;
189 , ;		;

- (19) Have you ever filed an application for any position in the service of the state, or any city in the state? If so, state when and where and for what service.

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(20) Have you ever been examined for the public service of the United States, or any state or city? If so, when [giving month and year], where, for what branch and grade of the service, and with what result?

(21) Have you ever been employed in the service of the United States, or any state, city or town? If so, state what service, when, where, and, if you have left it, the date and specifically the cause of leaving.

(22) Is your name on any eligible list of applicants for appointment? If so, on what list?

(23) Were you ever in the military or naval service of the United States in time of war? If so, state (1) in what regiment and company, or on what vessel you served, and the date and period of your service; and (2) whether you were honorably discharged; and (3) whether such discharge was by reason of disability resulting from wounds or sickness incurred in the line of duty.

(24) In what schools, academies or colleges were you educated? [Give the name and length of course in each.]

(25) Have you had any experience, or do you possess any special qualifications, such as a knowledge of book-keeping, expert penmanship, stenography, type-writing, foreign languages or other subjects, which, in your opinion, would be useful in the public service?

Every applicant for a position where an age limit is established by the rules will be required to furnish a certificate of the correct date of his birth before his application will be received.

Every applicant for police or fire service in any city will be examined upon the duties of the department for which he applies, and he is entitled to receive from the Commissioners or Board of Examiners a pamphlet containing the necessary information, after filing his application.

COMMONWEALTH OF MASSACHUSETTS.

ss.

On this day of 189 , personally appeared the above-named applicant and made oath that the handwriting in the above application paper is his own, and that the statements and answers therein contained, whether in writing or in print, are true to the best of his knowledge and belief.

Before me, .

Justice of the Peace.

N. B. — You must make oath or affirmation to this application before mailing it to the Commissioners or to the Board of Examiners. But before doing so, see that you have fairly answered every question, and that all proper blanks are filled, as otherwise the application will be returned to you for correction and your examination may be delayed.

The persons who sign the following vouchers are notified that they may be called upon to furnish further information concerning their knowledge of the applicant or to have the certificates published for public information.

CERTIFICATES.

Directions.

1. Not less than three nor more than five persons must certify to the character of the applicant, *and certificate No. 1 must be filled, as the other certificates refer to it.* It is desirable that one of the certificates should be signed by a physician.

2. They should be citizens of good character and standing in the community where they reside. If related to the applicant the relationship should be stated.

3. The Civil Service Act contains this language: "Sect. 5. That no recommendation of any person who shall apply for office or place under the provisions of this act, which may be given by any senator or member of the house of representatives, alderman or councilman, *except as to the character or residence of the applicant*, shall be received or considered by any person concerned in making any appointment under this act."

4. *Each blank below must be filled as accurately as practicable.*

I [being more than twenty-five years of age] have been a resident of _____ for _____ years last past. I am personally acquainted with _____ the applicant aforesaid; and I do state upon honor as follows:—

(1) That I have known said applicant well since _____.

(2) That I have read the application of said applicant, and believe each of the statements made therein to be true.

(3) That said applicant has not, to my knowledge or belief, any physical or mental weakness or infirmity, unless that mentioned in his application, which would disqualify him for the service he seeks.

(4) That said applicant is to my knowledge of good character and capacity, and is of good repute in the community where he lives.

(5) That discreet men would have no good cause to refuse, and I would not refuse, to employ the applicant in private business by reason of his lack of any of the qualifications aforesaid.

(Signature.)

(Post-office address.)

(Occupation.)

[The official paper contains four more forms.]

VETERAN EXEMPTION.

[This application can be used and filed only by a person who served in the United States army or navy during the War of the Rebellion, and was honorably discharged therefrom, and who desires appointment to office without examination. Each applicant must place on file with his application certificates from the proper authorities, which will furnish evidence of his service in the time of the War of the Rebellion and his honorable discharge. If the applicant was credited to the quota of a State the Adjutant General of that State will furnish a certificate. If he served in the regular army or navy the certificate must come from the Army or Navy Department at Washington.]

DIRECTIONS.

1. This form of application is prepared under the law allowing the appointment without examination of persons who served in the army or navy of the United States in the time of the War of the Rebellion, and were honorably discharged therefrom. *It can be used only by veterans entitled under the law, and desiring to have their names placed on the eligible list without having passed any examination provided for by the Civil Service Act and Rules.*

2. Every applicant, upon the filing of this application, with the required certificates hereto attached, will have his name entered on an eligible list for the office he seeks.

3. All the statements in the application are to be made under oath or affirmation.

4. A false statement knowingly made in this paper, or connived at in any certificate which may accompany the same, is good cause for exclusion from the eligible list or discharge during or after probation.

5. A failure to fill properly the blanks, or to send satisfactory certificates, will cause the application paper to be returned for correction.

6. Send application, after being filled out, if for service in the Commonwealth of Massachusetts or the city of Boston, addressed to the "Civil Service Commissioners, State House, Boston, Mass." If for local service in any other city, send application to the Secretary of the Board of Examiners of the city in which the service is sought.

APPLICATION.

I desire appointment, without passing any examination provided by the Civil Service Act or Rules, to the position of
 [State clearly and distinctly the position or branch of service to which you wish to be appointed, and whether it is in the service of the State or of a city.]

I declare the following to be facts concerning myself, viz. : —

- (1) My full name is
- (2) My post-office address is [give town or city, including street, number and ward.]
- (3) My actual bona fide [legal] residence at this time is in [the town or city of]
- (4) I have been a resident of the State of Massachusetts during the period of
[N. B. — If a naturalized citizen or if your parents were naturalized during your minority, give date and court of naturalization.]
- (5) I have been a resident of the [town or city of] during the past years, and am of good moral character.
- (6) My present occupation is
- (7) To the best of my information and belief, I was born at , on the day of , 18 , and I am therefore years of age.
- (8) I am not “a person habitually using intoxicating beverages to excess” nor a “vendor of intoxicating liquors.”
- (9) I have not been convicted of any offence against the laws of the Commonwealth during the past year.
- (10) I believe and represent myself to be a person without mental or physical impairment, of which I am aware, which in fact incapacitates me for a full discharge of official duty in the service which I seek to enter.
- (11) State your service in the army or navy of the United States in the time of the War of the Rebellion; in what regiment or regiments and company or companies, or what vessel or vessels you served. Give answers to cover all service performed, and (2) state the date of enlistment and discharge from each term of service.
- (12) State whether you were honorably discharged after each term of service, and (2) whether such discharge was by reason of disability resulting from wounds or sickness incurred in the line of duty.
- (13) Were you ever in the public service? If so, state what service, when, at what place, and, if you have left it, the date and specifically the cause of leaving.

COMMONWEALTH OF MASSACHUSETTS.

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On this day of 189 , personally appeared the above-named applicant and made oath that the statements and answers contained in the above application by him made, whether

in writing or in print, are true to the best of his knowledge and belief, and that he is qualified to perform the duties of the position which he seeks.

Before me,

Justice of the Peace.

N. B.— You must make oath or affirmation to this application before mailing it to the Commissioners or to the Board of Examiners. But before doing so, see that you have fairly answered every question and that all proper blanks are filled, as otherwise the application will be returned to you for correction and your registration delayed.

The persons who sign the following vouchers are notified that they may be called upon to furnish further information concerning their knowledge of the applicant or to have the certificates published for public information.

CERTIFICATES.

Directions.

1. Not less than three persons must certify to the character of the applicant, and certificate No. 1 must be filled, as the other certificates refer to it.

2. They must be citizens of good repute in the community. If related to the applicant the relationship should be stated.

3. Each blank below must be filled as accurately as practicable.

I [being a citizen of good repute in the community] have been a resident of _____ for _____ years last past. I am personally acquainted with _____ the applicant aforesaid; and I do state upon honor as follows:—

(1) That I have known said applicant well since

(2) That I have read the application of said applicant, and believe each of the statements made therein to be true.

(3) That said applicant has not, to my knowledge and belief, any physical or mental impairment which would in fact incapacitate him for the service he seeks.

(4) That said applicant is to my knowledge of good character and capacity, and is of good repute in the community where he lives.

(5) That I know said applicant to be fully competent to perform the duties of the position sought.

(Signature.)

(Post-office address.)

(Occupation.)

[*The official paper contains two more forms.*]

EXAMINATION PAPERS.

SCHEDULE A — CLASS 1.

[Limited Examination.]

Clerical Service.

First Subject:

Writing from dictation, — eighteen to twenty words a minute.

Copying rough draft of a letter containing interlineations, abbreviations, etc.

Spelling.

Handwriting; shown in copying rough draft.

Second Subject:

1. Write in figures the following number: —

Seventy million one thousand six.

Write in words the number expressed by the following figures: — 1,010,107 $\frac{1}{2}$

2. Add these *across*, placing the totals in the space indicated; then add the totals.

						Totals.
21,306	8,354	17,000	19,405	41,739	10,854	
18,356	17,437	18,438	4,223	22,972	19,857	
17,694	76,495	34,965	12,674	33,865	3,643	
13,400	27,865	28,965	18,430	33,301	15,210	
17,653	16,859	23,246	18,370	22,502	18,326	

3. What is the sum of $\frac{3}{8}$, $\frac{7}{8}$ and $\frac{5}{8}$? *Give the work in full*, using the lowest common denominator. Give the answer in mixed numbers.

Divide $\frac{6}{9}$ by $\frac{4}{7}$. *Give the work in full*. Give the answer in mixed numbers.

4. Subtract $1\frac{1}{8}$ from $\frac{5}{8}$, and change the result to a decimal. *Give the work in full*.

To forty-three and fifteen thousandths add three and thirty-seven hundredths. *Give the work in full*.

5. Multiply 7.6953 by 3.006. *Give the work in full.*
Divide eighty-seven by three thousandths. *Give the work in full.*
6. A man owning $\frac{6}{17}$ of a ship sold $\frac{5}{12}$ of his share for \$3,050; what is the whole value of the ship at this rate? *Give the work in full.*
7. If 6 men can mow a field in 10 hours, how many men must be added to mow it in 2 hours? *Give the work in full.*
8. A and B together own \$98.64. If they buy sugar at 9 cents per pound, B can buy 98 pounds more than A. How many pounds can A buy? *Give the work in full.*
9. A man sold wheat at a gain of $33\frac{1}{3}$ per cent; the selling price was \$1 per bushel. What was the cost? *Give the work in full.*
10. A farm was bought for \$18,000, which was 25 per cent. less than the price asked for it; what was asked for it? *Give the work in full.*

Third Subject:

Writing a letter on some subject given at the examination.

[This exercise is designed chiefly to test the applicant's skill in English composition, knowledge of the use of punctuation marks and capitals, paragraphing, etc.]

The letter should be signed with the applicant's number, not his name.

SCHEDULE A — CLASS 2.*

[General Examination.]

Clerical Service.

First Subject:

Writing from dictation, — eighteen to twenty words a minute.

Copying rough draft of a letter containing interlineations, abbreviations, etc.

Spelling.

Handwriting; shown in copying rough draft.

Second Subject:

1. Write in figures the following number: —

Four million six thousand ten and fifteen thousandths.

Write in words the number expressed by the following figures: —

2,701,011 $\frac{2}{3}$

2. Add these *across*, placing the totals in the space indicated; then add the totals.

* To become eligible, applicants who take the general examination must obtain sixty-five per cent. in each of the first three subjects.

Totals.					
27,638	79,542	34,695	7,560	68,437	22,360
28,475	42,863	8,375	235,864	17,397	68,474
23,343	29,988	26,837	23,776	6,356	49,698
64,958	75,542	53,285	19,240	5,683	18,878
35,456	232,674	23,540	35,896	34,963	66,560

3. What is the total weight of 4 hogsheads of sugar, weighing respectively $936\frac{1}{2}$, $1,025\frac{9}{10}$, $864\frac{2}{3}$ and 987 pounds, deducting 10 per cent. for tare? *Give the work in full.*
What number is that which, if multiplied by $11\frac{1}{3}$, will produce $9\frac{1}{11}$? *Give the work in full.*
4. The sum of three numbers is $18\frac{3}{4}$, and two of the numbers are $7\frac{1}{2}$ and 3.001; what is the other? *Give the work in full.*
5. The steamer "Teutonic" made the run from Queenstown to Sandy Hook in 5 days, 21 hours and 55 minutes. Her daily runs were 474, 490, 482, 494, 491 and $407\frac{1}{2}$ miles. What was the average rate of speed per hour? *Give the work in full.*
6. What would be the cost of paving a hall, 150 feet long and 50 feet wide, with marble slabs 12 inches long and 9 inches wide, the price of slabs being \$25 per dozen? *Give the work in full.*
7. If 264 bricks, each $8\frac{1}{2}$ inches long and $4\frac{1}{4}$ inches wide, will pave a given area, how many bricks, each $8\frac{1}{4}$ inches long and 4 inches wide, will pave $3\frac{1}{2}$ times that area? *Give the work in full.*
8. If \$39.45 is divided among 23 boys and 37 girls so that each boy receives 15 cents more than each girl, how much does each boy and each girl receive? *Give the work in full.*
9. If the tax on a piece of property is \$186.30, the rate being \$13.80 per thousand dollars, what is the value of the property? *Give the work in full.*
10. If a commission merchant has \$1,804 to expend, which includes his commission of $2\frac{1}{2}$ per cent., what amount of goods can he purchase? *Give the work in full.*

Third Subject :

1. Find the interest on \$762 for 5 months and 24 days at the rate of 6 per cent. a year. *Give the work in full.*
2. Find the interest on \$670 from Jan. 12, 1890, to Aug. 15, 1890, at 7 per cent. per annum. *Give the work in full.*
3. At compound interest, what will \$240 amount to in 3 years and 6 months, the rate being 5 per cent. a year? *Give the work in full.*
4. If a note for \$782, dated June 22, at 6 months, is discounted at a Boston bank August 10, the rate being 6 per cent. a year, what will be the proceeds? *Give the work in full.*
5. If \$200 is the interest on \$750 for $5\frac{1}{2}$ years, what is the rate per annum? *Give the work in full.*

Fourth Subject :

Writing a letter on some subject given at the examination.

[This exercise is designed chiefly to test the applicant's skill in English composition, knowledge of the use of punctuation marks and capitals, paragraphing, etc.]

The letter should be signed with the applicant's number, not his name.

SCHEDULE A — CLASS 3.

*Stenographer and Type-writer.**First Subject :*

Copying printed matter, thus showing handwriting and accuracy in copying. Spelling: twenty words announced by the examiner.

Second Subject :

Arithmetic: addition, common and decimal fractions, percentage, proportion.

Special Subject :

Short-hand writing and type-writing. Two tests of skill and accuracy in taking short-hand notes are given, one at the rate of 75 words and one at the rate of 100 words a minute. These words are then transcribed by the use of the type-writing machine.

Type-writing printed matter, showing accuracy, speed and technique.

Tabulating, transcribing rough draft of a report, and making corrected copy of a rough unpunctuated letter.

Test of speed in type-writing from dictation.

SCHEDULE A — CLASS 3.

*Inspector : Water Department.**First Subject :*

State how long you have resided in this city and what your trade or occupation has been since you began to earn your living.

If you have learned a trade, state where and under whom you learned it, and how long you worked at it.

If you have had any practical experience in the duties of the office for which you apply, or of any similar office, state when, where, for how long and under whom you had it.

State also any experience you may have obtained in business life or in the superintendence of others, either in public or private business.

If you are familiar with any foreign language, state what language it is.

Write not less than ten lines. Do not sign your name.

[On this the applicant is marked for clearness and correctness of statement, and for experience.]

Second Subject :

1. Write in figures the following number : —

One hundred eleven thousand three hundred six.

Write in words the number expressed by the following figures : —

49,852

2. Add the following column of figures : — 27,896

35,427

12,397

75,556

29,872

12,387

3. An army of 10,000 men lost 4,809 men in battle ; how many men were left? *Give the work in full.*

4. How much will 72 barrels of flour weigh, if each barrel weighs 196 pounds? *Give the work in full.*

5. How many horses worth \$125 apiece must be given for a farm worth \$11,000? *Give the work in full.*

6. What will be the cost of 32 pounds of coffee at 28½ cents a pound? *Give the work in full.*

Third Subject :

Copying a printed statement, thus showing handwriting and accuracy in copying.

Fourth Subject :

Questions to test the applicant's knowledge of the water service, causes of waste, etc.

Fifth Subject :

Reading a water meter.

SCHEDULE A — CLASS 3.

Inspector : Health Department.

First, second and third subjects the same as for Water Inspector.

Fourth Subject :

Questions relating to the duties of Health Inspector; contagious diseases; fumigation and purification; deodorants, disinfectants, etc.

SCHEDULE A — CLASS 3.

Inspector of Plumbing.

First Subject :

Make a written statement in relation to your experience as a plumber; where and of whom you learned the trade; how long you served as an apprentice; how long you served as a journeyman; and, if a master plumber, how long you have been one.

State particularly where and in what capacity you have been employed during the last five years.

Give the names of your employers during the last three years.

Write not less than ten lines. Do not sign your name.

[On this the applicant is marked for clearness and correctness of statement, and for experience.]

Second and third subjects the same as for Water Inspector.

Special Subject :

Questions relating to sanitary plumbing.

SCHEDULE B — CLASS 1.

Prison Service.

First Subject :

Writing down from memory the substance of matter orally communicated.

Second Subject :

The answers to the questions on this sheet will be marked as a whole under two heads, — EXPERIENCE, and CLEARNESS AND CORRECTNESS OF STATEMENT. *Any false statement made by the applicant in answering these questions will be regarded as good cause for excluding him from the eligible list, or for removal or discharge during probation or thereafter.*

1. State in general terms your occupation since you became of age, and any experience you may possess which will be of use, if you should receive an appointment in the prison service.
2. If you have ever served in the prison department in any capacity, or in any public office, state when, where, how long, whether you were ever discharged for cause, or requested to resign; and whether, while in office, you were ever complained of for violation of the rules of the office, or for any conduct unbecoming an officer; and, if such complaint was made, what action was taken thereon.
3. Have you ever been convicted of any offence against the laws of this or any other State or nation?
4. Have you ever been a dealer in intoxicating liquors, or a bar-tender? If so, when, where and for how long?
5. Do you ever drink distilled or fermented liquors of any kind? If so, state fully and definitely what your habits are in such use of them. If you are a total abstainer, state how long you have abstained.
6. Have you served in the army or navy of the United States, either in time of peace or war; and, if so, how long did you serve, and in what capacity, and did you receive an honorable discharge therefrom?
7. If you have ever served in the volunteer militia, name the regiment and company, and state how long and in what capacity you served, and whether you have been honorably discharged, been dismissed, have resigned or been asked to resign.
8. Have you ever had the handling of men, either in public office or private employment?

Third Subject :

1. Write in figures the following numbers : —
Two thousand seven hundred forty-two.
Six hundred seventy dollars three cents.

2. Write in words the numbers expressed by the following figures : —

3,742
\$693.51
3. Add the following column of figures : —

375
2,146
1,989
2,432
867
1,233
4. From 27,321 subtract 18,465. *Give the work in full.*
5. Divide 1,554 by 42. *Give the work in full.*
6. Multiply 305 by 46. *Give the work in full.*
7. If a man works twenty-six days at two dollars and twenty-five cents per day, how much money will he earn? *Give the work in full.*

Fourth Subject :

Copying a printed statement, thus showing handwriting and accuracy in copying.

PHYSICAL EXAMINATION.

SCHEDULE B — CLASS 1.

The Applicant will fill out this portion of the blank.

- Name,
- Date of birth,
- Occupation,
- Have you any disease now?
- What diseases have you had during the last seven years?
- Have you varicose veins or hernia?
- Have you ever had fits?
- Have you ever had any fracture or dislocation?
- Have you ever received any injury to the head or spine?
- Are you subject to piles?
- Have you been vaccinated?
- Have you ever had rheumatism?

*STATE THE EXACT weight, A; height, B; circumference of chest, C.	WEIGHT. A.	HEIGHT.		C.† At forced expiration, inches. On full inspiration, "
		B. Feet.	Inches.	
A. IS THE RESPIRING murmur clear and distinct over both lungs? B. Is the character of the respiration full, easy, and regular? C. Are there any indications of disease of the organs of respiration or their appendages?	A. B. C.			
A. IS THE CHARACTER of the heart's action uniform, free and steady? B. Are its sounds and rhythm regular and normal? C. Are there any indications of disease of this organ or of the blood vessels?	A. B. C.			
A. IS THE SIGHT GOOD? B. Is the hearing good?	A. B.			
IS THE APPLICANT subject to cough, expectoration, difficulty of breathing, or palpitation?				
A. ARE THE FUNCTIONS of the brain and nervous system in a healthy state? B. Has the brain or spinal cord ever been diseased?	A. B.			
IF THE APPLICANT has had any serious illness or injury, state expressly what effect, if any, is perceptible in the heart, lungs, kidneys or other abdominal organs, or the skin, eyes, ears, limbs, etc.				
HAS THE APPLICANT any predisposition, either hereditary or acquired, to any constitutional disease, as phthisis, scrofula, rheumatism?				

DOES THE APPLICANT display any evidence of having or having had syphilis?†																																																																			
HABITS, use of stimulants and tobacco.																																																																			
HAS THE APPLICANT any peculiarities in his walk or general carriage or of facial expression or marks, which would make him an object of remark?																																																																			
* The examiners are called upon to pay special attention to the annexed schedule in determining the fitness of the applicant. † There should be a difference, at least, of two inches at forced expiration and on full inspiration. All examinations of the chest should be made on the bare body, and not through the clothing. † Syphilitic taint in the applicant must always be regarded as good cause of rejection. ** Obesity must be regarded as a good cause for rejection.	† Minimum circumference of the chest tolerable in applicants.	STATURE AND WEIGHT. — The stature shall not be below 5 ft. 8 in., in ordinary dress, nor the weight below that marked as its minimum accompaniment in the subjoined table: **																																																																	
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(a) In examining the sense of sight, not only shall the general condition of the organs be ascertained, but weight shall be given to quickness and accuracy in discriminating colors and distances. The hearing shall be tested also as to keenness and correctness in distinguishing degrees and kinds of sounds, and the direction from which they come.

Remarks.

I, _____, hereby declare that I have returned true answers to the inquiries of _____ touching my personal and family health, history, habits, and antecedents; and that I am the person described in the foregoing record of examination.

Certificate of Examining Surgeon.

I hereby certify that I have this day carefully and thoroughly examined, in accordance with the foregoing instructions, _____, and find that he is _____ sound in limb and body, is _____ able bodied _____ of a robust constitution, has _____ good eyesight and _____ good hearing, and in my opinion is _____ physically qualified to sustain the labors and exposures, and perform the duties of a prison officer, and that the above is a truthful record of the examination.

Medical Examiner.

SCHEDULE B — CLASS 2.

Fire Department of Boston.

For Admission to the Force as Call-man or Permanent Substitute.

First Subject :

Copying a printed statement, thus showing handwriting and accuracy in copying.

Second Subject :

The answers to the questions on this sheet will be marked as a whole under two heads,— EXPERIENCE, and CLEARNESS AND CORRECTNESS OF STATEMENT. *Any false statement made by the applicant in answering these questions will be regarded as good cause for excluding him from the eligible list, or for removal or discharge during probation or thereafter.*

State, fully and completely, the kind or kinds of business or occupation in which you have been engaged since you began to earn your own living, the length of time at each, and any experience you may possess which will be of use if you should receive an appointment in the fire service.

If you have ever served in the fire department in any capacity, or in any public office, state when, where, how long, whether you were ever discharged for cause, or requested to resign; and whether, while in office, you were ever complained of for violation of the rules of the office, or for any conduct unbecoming an officer; and, if such complaint was made, what action was taken thereon.

Have you ever been convicted of any offence against the laws of this or any other state or nation? If so, make a full statement of the case, giving particulars as to date, place, your age at the time, the nature of the offence, the penalty, and all other facts relating thereto.

Have you ever been a dealer in intoxicating liquors, or a bartender? If so, when, where, and for how long?

Do you ever drink distilled or fermented liquors of any kind? If so, state fully and definitely what your habits are in such use of them. If you are a total abstainer, state how long you have abstained.

Have you served in the army or navy of the United States, either in time of peace or war; and, if so, how long did you serve, and in what capacity, and did you receive an honorable discharge therefrom?

If you have ever served in the volunteer militia, name the regiment and company, and state how long and in what capacity you served, and whether you have been honorably discharged, been dismissed, have resigned, or been asked to resign.

Have you ever had the handling of men, either in public office or private employment? If so, state how many, and in what kind of work.

In your opinion, what particular qualities should a good fireman possess?

Third Subject :

1. Write in figures the following number : —

Ten thousand one hundred one.

Write in words the number expressed by the following figures : —

20,306

2. Add the following column of figures : —

27,685

86,457

12,294

3,783

19,651

48,969

3. If a ship worth \$25,000, insured for \$19,875, should be lost, how much will the owners lose? *Give the work in full.*
4. If 27 cows cost \$2,315.25, what is the cost of each cow? *Give the work in full.*
5. How much will 38 barrels of flour weigh if each barrel weighs 209 pounds? *Give the work in full.*
6. What will 36 pounds of coffee cost at 33 $\frac{3}{4}$ cents a pound? *Give the work in full.*

** Fourth Subject :*

Questions relating to the duties of a fireman, as prescribed by the Board of Fire Commissioners.

* Each applicant for the fire service of Boston is furnished, at the time of filing his application, with a small book containing some of the most important rules and regulations found in the fire manual. He is also informed that he must study them carefully, and be prepared to answer questions relating to them.

PHYSICAL EXAMINATION.

SCHEDULE B — CLASS 2.

I, [Write your full name.] , hereby declare that the answers to the following questions relating to my personal and family health, history, habits, and antecedents, are true to the best of my knowledge and belief, and that I am the person described in the following record of examination.

The Applicant will fill out this portion of the blank.

What is your occupation?

Do you use tobacco? If so, in what manner, and how much do you use in a week?

Do you drink intoxicating liquors? If so, how frequently?

Have you any disease now?

What diseases have you had during the last seven years?

Do you know of any hereditary disease in your family?

If your parents, brothers, or sisters, or any of them, are dead, of what disease did they die?

Have you ever had fits?

Have you ever had any fracture or dislocation?

Have you ever received any injury to the head or spine?

Are you subject to piles?

Have you been vaccinated?

Have you ever had rheumatism?

Certificate of Examining Surgeon.

Are there any indications of disease of the organs of respiration or their appendages?	
Are there any indications of disease of the heart or of the blood vessels?	
Is the sight good?	
Is the applicant color blind?	
Is the hearing good?	
Are the functions of the brain and nervous system in a healthy state?	
Has the applicant varicose veins?	
Has the applicant hernia?	
Is the applicant flat footed or has he any other malformation or disease of the feet?	

If the applicant has had any serious illness or injury, state expressly what effect, if any, is perceptible in the heart, lungs, kidneys or other abdominal organs, or the skin, eyes, ears, limbs, etc.	
Has the applicant any predisposition, either hereditary or acquired, to any constitutional disease, as phthisis, scrofula, rheumatism?	
* Does the applicant display any evidence of having or having had syphilis?	

* Syphilitic taint or obesity must be regarded as good cause for rejection.

Remarks.

I hereby certify that I have this day carefully and thoroughly examined the above-named applicant, and find that he is sound in limb and body, is able-bodied, of robust constitution, has good eyesight and good hearing, and in my opinion is physically qualified to sustain the labors and exposures, and perform the duties of a fireman in the city of Boston, and that the above is a truthful record of the examination.

Asst. City Physician.

EXAMINATION IN DEVELOPMENT AND STRENGTH.

Applicant for Policeman of Boston.

	Measure- ment.	Per Cent.	Weight.	Product.																																																																						
Age, weight,					<div>The stature shall not be below 5 feet 8 inches, in bare feet, nor the weight below 140 pounds, naked.</div> <div>All measurements shall be made on the bare body.</div> <div>The examiner is called upon to pay special attention to the annexed schedules in determining the fitness of the applicant.</div>																																																																					
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Sitting height, ft. in.																																																																										
Girth, waist, .	{ A. B. C.		5 4 2		<table><tr><th colspan="2">HEIGHT.</th><th>CIRCUMFERENCE</th><th colspan="2">HEIGHT.</th><th>WEIGHT.</th></tr><tr><th>Feet.</th><th>Inches.</th><th>OF CHEST. Inches.</th><th>Feet.</th><th>Inches</th><th>Pounds.</th></tr><tr><td>5</td><td>8</td><td>34</td><td>5</td><td>8</td><td>140</td></tr><tr><td>5</td><td>9</td><td>34½</td><td>5</td><td>9</td><td>145</td></tr><tr><td>5</td><td>10</td><td>35</td><td>5</td><td>10</td><td>150</td></tr><tr><td>5</td><td>11</td><td>35½</td><td>5</td><td>11</td><td>155</td></tr><tr><td>6</td><td>-</td><td>36</td><td>6</td><td>-</td><td>160</td></tr><tr><td>6</td><td>1</td><td>36½</td><td>6</td><td>1</td><td>165</td></tr><tr><td>6</td><td>2</td><td>37</td><td>6</td><td>2</td><td>170</td></tr><tr><td>6</td><td>3</td><td>37½</td><td>6</td><td>3</td><td>175</td></tr><tr><td>6</td><td>4</td><td>38</td><td>6</td><td>4</td><td>180</td></tr></table>				HEIGHT.		CIRCUMFERENCE	HEIGHT.		WEIGHT.	Feet.	Inches.	OF CHEST. Inches.	Feet.	Inches	Pounds.	5	8	34	5	8	140	5	9	34½	5	9	145	5	10	35	5	10	150	5	11	35½	5	11	155	6	-	36	6	-	160	6	1	36½	6	1	165	6	2	37	6	2	170	6	3	37½	6	3	175	6	4	38	6	4	180
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Girth, L. forearm, .			1																																																																							
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					Strength of lungs, . . .		2																																																																			
					Strength of back, . . .		3																																																																			
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Development,					Strength,																																																																					

	Per Cent.	Weight.	Product.
Development, . . .		1	
Strength,		2	
		3	
General physical condition, . . .			

Remarks.

I hereby certify that I have this day of , 189 ,
carefully and thoroughly examined the above-named applicant, and
that the above is a truthful record of such examination.

Physical Examiner.

SCHEDULE B — CLASS 5.

*Draw-tender of Bridges.**First Subject:*

State your occupation during the past ten years, and the names and residences, so far as you remember, of your employers during that period.

Have you ever served as draw-tender or assistant draw-tender?

If so, when and where?

Can you pull and manage a row-boat?

Can you swim?

Can you run a stationary engine?

Can you furnish a certificate that you can do so?

[On these statements the applicant is marked for experience only.]

Second Subject:

1. Write in figures the following number: —

One thousand five hundred and sixty-three dollars and fourteen cents.

2. Write in words the number expressed by the following figures: — 14,368

3. Add the following column of figures: — 1,792

3,467

1,823

3,119

427

2,236

4. From 21,315 subtract 19,678. *Give the work in full.*

5. Divide 4,968 by 23. *Give the work in full.*

6. Multiply 726 by 54. *Give the work in full.*

Third Subject:

Questions relating to the duties which draw-tenders are called upon to perform.

SCHEDULE B — CLASS 6.

*Foreman of Laborers.**First Subject:*

State your occupation during the past ten years, and the names and residences, so far as you remember, of your employers during that period.

Have you ever been foreman or sub-foreman in charge? If so, state when, where and under whom you worked, and the kind of work in which you were employed.

Have you ever had charge of men? If so, state fully how many, where, when, for how long and in what kind of work.

Have you ever done any ledge work, or had the handling or care of explosives? If so, state when, where and for how long.

[On these statements the applicant is marked for experience only.]

Second Subject :

1. Write in figures the following number : —

One thousand five hundred sixty-three.

Write in words the number expressed by the following figures : —

12,207

2. Add the following column of figures : — 1,743

876

1,427

3,764

998

2,507

3. Suppose you have under you 36 men at \$1.75 per day; a rain-storm prevents them from working the last half day. What will be the amount of their pay for that day? *Give the work in full.*

4. If you have a pile of 10,000 bricks, and take away 7,550 of them, how many will be left? *Give the work in full.*

5. When stone is worth 88 cents a yard, how many yards can be bought for \$37.85? *Give the work in full.*

Third Subject :

Foreman in the water department.

Questions on trench work, pipe-laying, measurements and materials.

Third Subject :

Foreman in sewer department.

Questions relating to the different kinds of sewers, the preparation and use of cement and other materials, and trench work.

Third Subject :

Foreman in the department of streets, parks, cemeteries, common and squares.

Questions on street, road and sidewalk building, cart measurement, grade-stakes, etc.

Fourth Subject :

Foreman in all the departments except the street cleaning and sanitary departments.

Questions on ledge work, and the care and use of explosives.

Fifth Subject :

Foreman in the department of streets, parks, cemeteries, common and squares.

Questions on drainage.

SCHEDULE B — CLASS 6.

Sub-foreman of Laborers.

First Subject :

State your occupation during the past ten years, the names and residences, so far as you remember, of your employers during that period.

Have you ever been foreman or sub-foreman in charge? If so, state when, where, and under whom you worked, and the kind of work in which you were employed.

Have you ever had charge of men? If so, state fully how many, where, when, for how long and in what kind of work.

Have you ever done any ledge work, or had the handling or care of explosives? If so, state when, where and for how long.

[On these statements the applicant is marked for experience only.]

Second Subject :

1. Write in figures the following : —

One hundred and sixty-three dollars and twelve cents.

2. If you receive 23 loads of gravel one day, 34 loads the next, and 17 loads the next, how many loads will you then have in all? *Give the work in full.*

3. If you have \$45 and pay out \$27 for rent and other expenses, how much will you have left? *Give the work in full.*

4. If a cubic yard of stone costs 88 cents, how many yards can be bought for \$39.60? *Give the work in full.*
5. What wages, at \$1.75 per day, would be due a laborer, he having worked an entire week of six days, except one half day? *Give the work in full.*

Third Subject:

Questions relating to general work: the use of tools, reading grade-stakes, tallying, etc.

Fourth Subject: (Not obligatory.)

Questions on ledge-work: the tools used, care and use of explosives, etc.

SCHEDULE B — CLASS 7.

Building Inspectors.

First Subject:

The answers to the questions on this sheet will be marked under two heads, — EXPERIENCE, and CLEARNESS AND CORRECTNESS OF STATEMENT. *Any false statements made by the applicant in answering these questions will be regarded as good cause for excluding him from the eligible list, or for removal or discharge during probation or thereafter.*

What is your trade or occupation?

Where and under whom did you learn your trade or occupation?

At what kind of work are you now employed, who is your employer, and how long have you been so employed?

If you are not at work now, state where and by whom you were employed last, the kind of work, and why you left that work.

Did your present or last employer sign a recommendation for you upon your present application? If not, why not?

Have you followed more than one trade or occupation? If so, state what trades or occupations you have followed other than the one you have already mentioned.

If there is anything else in your experience which may tend to show your fitness for the position of Building Inspector, state the same fully.

Have you ever been convicted of any offence against the laws of this or any other State or nation? If so, make a full statement of the case, giving particulars as to date, place, your age at the time, the nature of the offence, the penalty, and all other facts relating thereto.

Have you ever been a dealer in intoxicating liquors, or a bartender? If so, when, where, and for how long?

Do you ever drink distilled or fermented liquors of any kind? If so, state fully and definitely what your habits are in such use of them. If you are a total abstainer, state how long you have abstained.

Second Subject:

Copying printed matter, thus showing handwriting and accuracy in copying.

Third Subject:

Arithmetic.

Fourth Subject:

Questions relating to brick and stone masonry, carpentry and iron work.

Fifth Subject:

Knowledge of construction as shown by drawing plans to scale.

Sixth Subject:

Sanitary plumbing.

SCHEDULE B — CLASS 8.

Engineers, Janitors and Persons having Charge of Steam Boilers and Furnaces in the School Buildings in the City of Boston.

First Subject:

The answers to the questions on this sheet will be marked under the head EXPERIENCE. *Any false statement made by the applicant in answering these questions will be regarded as good cause for excluding him from the eligible list, or for removal or discharge during probation or thereafter.*

What is your trade or occupation?

Where and under whom did you learn your trade or occupation?

At what kind of work are you now employed, who is your employer, and how long have you been so employed?

If you are not at work now, state where and by whom you were employed last, the kind of work, and why you left that work.

Did your present or last employer sign a recommendation for you upon your present application? If not, why not?

Have you followed more than one trade or occupation? If so, state what trades or occupations you have followed other than the one you have already mentioned.

If there is anything else in your experience which may tend to show your fitness for the position you seek, state the same fully.

Have you ever had the charge or care of any building, public or private? If so, state the kind of building, where located, and how long you had the charge or care of it.

Have you had any experience in taking care of furnaces or heating apparatus? If so, state when and where, the kind of building heated, how long you were so employed, and what kind of heating apparatus was used.

Do you wish to be examined in steam engineering or steam heating?

Have you ever been a dealer in intoxicating liquors, or a bartender? If so, when, where, and for how long?

Have you ever been convicted of any offence against the laws of this or any other State or nation? If so, make a full statement of the case, giving particulars as to date, place, your age at the time, the nature of the offence, the penalty, and all other facts relating thereto.

Do you ever drink distilled or fermented liquors of any kind? If so, state fully and definitely what your habits are in such use of them. If you are a total abstainer, state how long you have abstained.

Second Subject :

Arithmetic : Six questions, including addition, subtraction, multiplication, division, and the reading and writing of numbers.

Third Subject :

Copying a printed statement, thus showing handwriting and accuracy in copying.

Fourth Subject :

Questions relating to the care and handling of furnaces, gas, water supply, etc., ventilation and sanitary matters.

[Each applicant for appointment to a position as engineer is required to exhibit a license from a State Inspector of Steam Boilers.]

[Each applicant for appointment to a position as janitor of a school building where steam heat is used will be required to exhibit a license from a State Inspector of Steam Boilers.]

SCHEDULE B — CLASS 9.

The Fire Service of Cities other than Boston.

This examination is similar to that of Schedule B, Class 2,—
the Fire Service of Boston.

SCHEDULE B — CLASS 10.

Truant Officers of Boston.

First Subject:

Copying printed statement.
Spelling.

Second Subject:

The answers to the questions on this sheet will be marked as a whole under two heads, — EXPERIENCE and CLEARNESS AND CORRECTNESS OF STATEMENT. *Any false statement made by the applicant in answering these questions will be regarded as good cause for excluding him from the eligible list, or for removal or discharge during probation or thereafter.*

State how long you have resided in this city, and what your occupation has been since you began to earn your living.

If you have had any practical experience in the duties of the office for which you apply, or of any similar office, state when, where, for how long and under whom you had it.

State also any experience you have had in the superintendence of others, either in public or private business.

If you are familiar with any foreign language, state what language it is, and whether you can read, write and speak it.

Write not less than ten lines. Do not sign your name.

Have you ever been employed as a public officer? If so, state what office you held, when, where, how long you served, whether you were ever discharged for cause, or requested to resign; and whether, while in office, you were ever complained of for violation of the rules of the office, or for any conduct unbecoming an officer; and, if such complaint was made, what action was taken thereon.

When were you born? Give month, day and year.

Have you ever served in the army or navy of the United States, either in time of peace or war? If so, how long did you serve and in what capacity, and did you receive an honorable discharge therefrom?

Have you ever served in the volunteer militia? If so, name the regiment and company, and state how long and in what capacity you served, and whether you have been honorably discharged, been dismissed, have resigned or been asked to resign.

Have you ever had the handling of men, either in public office or private employment? If so, state how many and in what kind of work.

Have you ever been convicted of any offence against the laws of this or any other State or nation? If so, make a full statement of the case, giving particulars as to date, place, your age at the time, the nature of the offence, the penalty, and all other facts relating thereto.

Have you ever been a dealer in intoxicating liquors, or a bartender? If so, when, where, and for how long?

Do you ever drink distilled or fermented liquors of any kind? If so, state fully and definitely what your habits are in such use of them. If you are a total abstainer, state how long you have abstained.

What particular qualities should a man possess in order that he may become an efficient truant officer?

Third Subject:

Arithmetic, including addition, subtraction, multiplication and common fractions.

Fourth Subject:

Letter writing.

SCHEDULE B — CLASS 11.

Janitors of School Buildings in Cities other than Boston.

An examination similar to that given for Schedule B, Class 8.

SPECIAL INSTRUCTIONS TO EXAMINERS.

The gentlemen designated as members of a Board of Civil Service Examiners will meet as soon as practicable, and organize the Board, choosing a chairman and secretary.

On receiving notice of such organization, the commissioners will forward to the secretary of the Board the application blanks, copies of the rules and regulations, and such other books, documents and papers as may be needful.

The commissioners will also send notices for insertion in local newspapers (as a matter of news), informing all who may be interested that application papers can be obtained of the secretary of the Board.

Each person filing an application blank should be furnished also with a copy of the rules and regulations.

When an application paper is presented by an applicant in person, the secretary should examine it at the time, if he can do so conveniently, and, if it is properly filled out, he should note upon the back, in ink, the date and hour when received. If it is not properly filled out, the attention of the applicant should be called to the fact, and he should be directed to have the application paper corrected.

If an incomplete application paper is received by mail, it should be returned to the applicant, accompanied by a notice to correct the same.

At each meeting of the Board the applications which have been received since the previous meeting should be carefully examined by the members, or a majority of them, and, if found satisfactory, should be numbered serially in the order in which they are received. They should be entered in the record of applications, in the order of their numbers.

The Board will reject any application which shows that the applicant is not, by reason of age, lack of citizenship, proper period of residence, etc., entitled by the law, rules and regulations to an examination; and it must be returned to him with a brief statement of the reasons for such action. A blank form will be furnished for this purpose.

All application papers will be received, if in proper form. Should any be received for positions in the service of the Commonwealth, or another city, they must be forwarded to the commissioners.

When, in the opinion of a majority of the Board, the three certificates as to character are not considered sufficient, by reason of the signers thereof not being reputable persons, the application paper shall be returned to the applicant, who shall be requested to furnish additional certificates.

When the application is for examination for the police service, the secretary of the Board will furnish the applicant with a copy of the book of instructions for police applicants, *and make note of having done so on the application paper.*

When, in the opinion of the Board, it is thought desirable to hold an examination, the secretary will notify the Civil Service Commissioners, and suggest a convenient time for such examination.

On receipt of authority from the commissioners, the secretary of the Board will send notice of such examination to each applicant.

Attention is called to Rule XVII., which gives precedence in notification, under certain circumstances, to those who served in the army or navy in time of war.

Examination blanks will be sent or brought to the Board before an examination is to take place; but they are not to be opened until the Board meets in the examination room on the morning of the examination day, and great care must be taken that they be kept in a secure place until that time.

When all are seated, one of the Board will take from each applicant the notice he has received to attend the examination.

The package of examination papers will then be opened, and each applicant will be given a numbered envelope and a declaration paper; upon the latter are printed questions concerning his name, age, former occupation, service in the army or navy in time of war, etc. These are to be answered in writing, and the writer will sign his name at the bottom of the sheet. This is the only time during the examination when the applicant will be allowed to affix his signature to a paper. After completing the declaration paper, he will fold and enclose it in the numbered envelope which has been given him, and then seal the envelope.

The number on the envelope will be his examination number, and he must write it upon each succeeding paper in the blank space left for that purpose.

It will be well to inform the applicants that they are to be examined in certain subjects, and state the order in which the subjects will be given out.

The envelopes are not to be opened until after all the examination papers have been marked and graded.

In examinations where one of the exercises consists of writing from dictation and spelling, all the applicants will work at the same time. In the other exercises they may consult their own convenience as to rapidity.

As a rule there will be no general recess during the examination hours; but any applicant may be allowed, for sufficient reason, to leave the room at any time when he has finished one set of questions and delivered the paper to one of the Board. No succeeding questions shall be given him, however, until his return.

It is advisable that the full Board of Civil Service Examiners be present at each examination; but a majority of the Board may conduct an examination in case of the disability or necessary absence of the other members.

At all times when an examination is in progress, one of the Board must be present.

Order and decorum should be preserved in the examination room, and visitors can be admitted only by invitation of one of the Board. No visitors shall be allowed to inspect the questions or answers, or procure for publication anything relating to them or the work of any applicant.

To obtain the best possible results, applicants whose natural nervousness is increased during examination should be made to feel as much at ease as possible. To do this will require great discretion on the part of members of the Board; and nothing will defeat this object so quickly as the knowledge, on the part of applicants, that they are observed, or that their work is being scrutinized by those not officially in charge.

Applicants should be cautioned not to use any books of reference or memoranda for the purpose of assisting their memories. Any one detected in doing so may be dismissed from the examination room. The same penalty will be enforced if one applicant attempts to assist another, by conversation or otherwise, in answering the questions given him.

Members of the Board should give the applicants general explanations only, and these should be limited to methods of procedure.

After an examination, all the papers should be taken charge of by the secretary of the Board.

Members of local boards are cautioned against furnishing information to any person in relation to the examinations, except in the general way prescribed in the rules.

All unused examination papers are to be returned to the commissioners the day after the examination.

As soon as practicable after completing the marking and grading of the papers, the secretary of the Board will send a certificate to each person who was examined, if he passed the examination, stating the standing which he obtained, as shown by the marking, and whether or not he is entitled to be recorded on the eligible list.

In the general regulations adopted by the commissioners will be found information as to marking and grading, and the enrolment in the proper register of the names of those found eligible for appointment.

The chief examiner or one of the commissioners will be present at the examination whenever it is practicable to do so.

More specific rules for marking the examination papers will be issued hereafter.

Necessary expenses incurred by members of the Board for stationery, postage and actual travel, will be allowed by the commissioners.

Whenever it appears to the Board of Examiners that the position to be filled requires special qualifications, and that the regular course of examination for that branch of the service would not meet the case, they will notify the commissioners of the facts, and ask for instructions as to the special course to be pursued. When the advice or assistance of experts is necessary, the Board will so inform the commissioners, and suggest the names of suitable persons who would be willing to aid them.

HENRY SHERWIN,
Chief Examiner.

FORMS FOR APPOINTING OFFICERS.

[The following forms are furnished for the information and convenience of officers making appointments to positions in the classified service of the Commonwealth and the cities thereof. They are furnished merely by way of suggestion, and not as forms prescribed by law to be strictly followed.]

Form for Nomination, by a Mayor, of Police Officers—Probationary Term.

I hereby nominate, subject to the approval and confirmation of the Board of Aldermen, _____, to be a police officer of the city of _____, with all the powers of a constable except the power of serving and executing civil process, to hold said office for a probationary period of six months, as provided in the civil service rules of the Commonwealth, unless sooner discharged.

Form for Nomination, by a Mayor, of Police Officers—After Probationary Term.

_____, having served as a police officer for a probationary period of six months, and his conduct and capacity having been found satisfactory, I hereby nominate, subject to the approval of the Board of Aldermen, said _____, to be a police officer of the city of _____, with all the powers of a constable except the power of serving and executing civil process.*

Form of Warrant for Police Officer appointed for Probationary Term.

This is to certify that _____ has been appointed a police officer of the city of _____, with all the powers of a constable except the power of serving and executing civil process, said appointment being made under the civil service rules of the Commonwealth for a probationary term of six months, beginning on the _____ day of _____ A D. 18 ____.

* In cities where the ordinances provide that appointment shall be made for a limited time, it would be well to add, "to hold office for the term and according to the tenure prescribed by the laws and ordinances."

FORMS FOR APPOINTING OFFICERS. 195

Form of Warrant for Police Officers appointed after Probationary Term.

This is to certify that _____, having served a probationary period of six months, as required by the civil service rules of the Commonwealth, has been appointed a police officer of the city of _____, with all the powers of a constable except the power of serving and executing civil process.*

Form of Notice to Persons, other than Police Officers, appointed for a Probationary Term.

This is to inform you that, under the provisions of the civil service rules, _____ ha selected you for appointment to the position of _____ in the _____ for a probationary term of six months from the date when you begin service. Should your conduct and efficiency during such probationary term prove satisfactory, you will, at its close, receive a regular appointment; otherwise your appointment will cease. The salary attached to such position is at the rate of \$ _____.

This conditional appointment does not preclude prompt discharge from service at any time during such probationary term, in case of misconduct or inefficiency.

A prompt reply is requested, stating whether this appointment is accepted, and giving the earliest date when you can present yourself for service.

Notice to Persons, other than Police Officers, appointed after Probationary Term.

Your conduct and capacity, during the probationary term of six months, having been found satisfactory, you are hereby appointed a _____ in the _____ department [or office] at a _____ salary of \$ _____, beginning on the _____ day of _____, A.D. 18 ____.

Notice to Persons whose Conduct or Capacity has not proved Satisfactory during the Probationary Term.

I have to inform you that your conduct [or capacity] during your employment in _____ department as _____, for a probationary term of six months, has not been found satisfactory, and that, in accordance with the terms of your original appointment, as prescribed in the civil service rules of the Commonwealth, your employment in said department will cease on the _____ day of _____, A.D. 18 ____.

* See note to second form.

INSTRUCTIONS TO APPLICANTS.

There are no regular times for holding examinations, and no definite information can be given as to when the next examination for any particular branch of the service will be held, but applications will be recorded at any time.

A person desiring to be examined for a position in the classified service should file his application on the prescribed blank; and a form for that purpose can be obtained at the office of the commissioners, room 152, State House, Boston, or of the secretary of the local board of examiners in the city where he lives.

Applications for the service of the Commonwealth and of the city of Boston should be filed in the commissioners' office, Boston; if for service in any city other than Boston, they should be filed with the secretary of the board of civil service examiners in such city.

The commissioners are unable to answer inquiries as to vacancies in the service, salaries, prospects of certification, appointment or promotion, or as to the course of preparation which applicants should follow (except as shown by the specimen examination papers printed in their report), or in relation to cases which are not before them for decision; nor can they decide, except in the cases of actual applicants, questions respecting the application of the rules. Particular answers cannot be given to inquiries which are answered herein, directly or by implication.

The relative standing of any applicant, as compared with that of others on the same eligible list, may be changed by the addition of names of persons who have obtained higher standing at some more recent examination, and the time of the examination is not considered in making certifications.

Eligibles are certified in the order of their grade, and nothing can help and nothing can hinder their certification for appointment in the order of eligibility as prescribed by the civil service rules.

The commissioners know nothing of vacancies until requested to certify names for filling them; and it can only be generally said that the highest mark possible is 100, the lowest which gives eligi-

bility is 65, and that the nearer the applicant's mark is to 100 the more likely it is that his name will be reached for certification. It is wholly uncertain, therefore, when an applicant's name may be reached for certification, and it is useless to speculate upon what his chances may be.

Applicants will save the commissioners and themselves time and trouble by carefully reading the foregoing, and preserving it for reference.

Very respectfully,

WARREN P. DUDLEY,
Secretary.

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OF THE

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1897.

Commonwealth of Massachusetts.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts in General Court assembled.

The undersigned, commissioners appointed under the provisions of chapter 476 of the Acts of 1893, entitled "An act to provide for the appointment of a Highway Commission to improve the public roads, and to define its powers and duties," herewith submit their fourth annual report.

THOMAS C. MENDENHALL.
NATHANIEL S. SHALER.
WILLIAM E. McCLINTOCK.

BOSTON, MASS., Jan. 6, 1897.

LIST OF OFFICERS OF THE MASSACHUSETTS
HIGHWAY COMMISSION.

THOMAS CORWIN MENDENHALL,	}	<i>Commissioners.</i>
NATHANIEL SOUTHGATE SHALER,			
WILLIAM EDWARD MCCLINTOCK,			

CHARLES MILLS,	<i>Chief Engineer.</i>
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AUSTIN BRADSTREET FLETCHER,	<i>Clerk.</i>
JOHN MICHAEL MCCARTHY,	<i>Assistant Clerk.</i>
WALTER EDWIN HITCHCOCK,	. . . . .	<i>Book-keeper.</i>
MARY ALOYSIUS RILEY,	<i>Stenographer.</i>
EDWARD AUGUSTUS AUSTIN,	<i>Messenger.</i>

LOGAN WALLER PAGE,	<i>Geologist.</i>
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ANNUAL REPORT

OF THE

MASSACHUSETTS HIGHWAY COMMISSION.

The appropriation by which the work of the Highway Commission was to be carried on during the season of 1896 did not become available until nearly three months of that season had passed. The act by which this appropriation was made (chapter 481, Acts of 1896) was approved on June 4, and the amount of the appropriation was \$600,000.

After a careful consideration of the conditions, it was deemed wise not to undertake any absolutely new constructions, but rather to press forward the extension of those already begun. With one or two minor exceptions, for which there were excellent reasons, this determination has been adhered to.

As soon as possible after the appropriation was available allotments were made to the several constructions under way, the necessary surveys and estimates were completed as rapidly as possible, and contracts were entered into for the execution of the work. In addition to the lay-out of previous years, 195,481 feet were laid out during the year 1896, bringing the total length up to 665,937 feet, or 126.17 miles. The loss of three months of the best part of the road-making season by delay in the appropriation necessarily resulted in a diminished construction. Notwithstanding the exceptionally favorable weather during the month of November, extending even into the first week of December, the season of actual road building was comparatively short.

About 47 miles of highway were actually finished during the year, bringing the total amount of completed State road

up to about 109 miles. A number of extensions laid out and partially built must await their completion on the opening of the spring. A full account in detail of the work of the year on each of the several roads will be found in the Appendix to this report.

Up to the beginning of the year there had been received 224 petitions for State highways, from city officers, county commissioners and town authorities. The number has been increased during the year by 83, making the total 307. The petitions received this year represent 78 municipalities.

MEETINGS OF THE COMMISSION.

The commission has held 68 meetings at its office during the year, besides many other meetings at different points in the State.

The office of the commission, which was until July 25 at 15 Court Square, Boston, was removed on that day to one of the buildings belonging to the State, 4 Mt. Vernon Street, where rooms on the second and higher floors were assigned to it by the governor and council. In its new location the work of the commission is more conveniently carried on, and there is a saving of about \$3,000 per annum in rental and other expenses necessary at the quarters previously occupied.

Regular meetings were held in every county of the State, as provided for and required by the statutes. Notice was given of these meeting some weeks in advance, and an opportunity was afforded to county, town and municipal authorities and to the general public to discuss and consider matters relating to the construction of State roads or the improvement of highways in general. Still other meetings were held in different localities, whenever it seemed desirable to enable the commission to form a correct judgment as to the question of taking a roadway under a properly prepared petition.

Every road under construction has been visited during the year by one or more members of the commission, and no road has been finally accepted from the contractor until it has been inspected and a favorable report has been made.

CONTRACTS.

In the last report the desirability of awarding contracts for building State roads to the town or municipal authorities having jurisdiction where they are built was discussed and affirmed. The commission still believes in the wisdom of this course, and for the reasons there given, even if the cost of construction shall be slightly greater than if let to private contractors. In some localities, however, the authorities do not elect to take the contract, and the number of lettings to private parties is, on the whole, increasing. In some towns there has been a loss encountered by the contractor on the completion of the work, and this fact has in some degree discouraged the taking of contracts by municipal or town authorities. In rare cases this loss has been due to erroneous estimates by engineers in the service of the commission, generally resulting from unforeseen difficulties in procuring or handling material. Wherever this has been found to be the case, the commission has dealt liberally with the town authorities, by making allowances for extra labor or cost of material which had not been provided for in the estimates on which the contract is based. In other cases the loss can unquestionably be attributed to careless business methods on the part of the town authorities. While this is something over which the commission has no control, and which it is generally quite unable to prevent, it feels compelled to refer to the matter, and to call attention, as it did in its report of a year ago, to the fact that the Commonwealth suffers in some degree through the delay which usually accompanies this condition of things, requiring the maintenance of a resident engineer at the place of operation for a longer period than would otherwise be necessary.

Attention is also invited to the paragraph in the last report in which reference is made to the practice of town or city authorities of paying more than the usual rate of wages in that locality to laborers whom they employ on the State highway, or of employing those who are not able-bodied. Considered from the stand-point of an economical and fair expenditure of the funds of the Commonwealth, such a practice is not to be commended, and the

commission cannot be expected to consider losses which originate in this way.

The question of the employment of persons not citizens of the Commonwealth in the construction of State roads has several times arisen during the year. Such employment is a direct violation of the law, and the commission has felt compelled to take decisive action in all instances of which it has had knowledge. The procedure in such cases has been as follows: Whenever it is reported that non-citizens are employed, the chief engineer has been directed to investigate the matter and report at once to the commissioners. If the report is verified, the contractor is notified that such employment must cease immediately, and that on a repetition of the offence the contract will be annulled. This notification has been sufficient, except in the case of two contracts, where it came to the knowledge of the commissioners that the employment of persons not citizens was continued after such notice, and in these cases the contracts were immediately annulled.

In the interpretation of the word "citizen" the commission has sought the advice of the Attorney-General, and in accordance therewith it is assumed to have its full meaning, the possession of "first papers" being not sufficient to constitute citizenship.

The table of Appendix B shows all contracts made during the year, with prices in detail.

LEGISLATION.

As all the legislation under which the Highway Commission is working is recent, it naturally and necessarily follows that when subjected to the test of actual practice it is almost certain to prove defective in some respects. It seems desirable to call attention in this report to a few of the imperfections in the statutes, which have somewhat embarrassed the commission in its work, and which may be easily removed by proper legislative action.

The delays, resulting in real losses, due to the lateness of the annual appropriation in the year 1896 and as well in the previous year, suggest the desirability of the appropriation of a fixed annual sum for a period of years, say five or ten, the money to become available without further legislative

action. There can be no question but that great gain would result from such a course, through the better control which the commission would have over the whole work, and the more economical administration of its funds which would then be secured. The convenience of the general public would also be greatly promoted, through the possibility of the execution of field work during that season in which the temporary interruption of the usual lines of travel would offer the least annoyance. It is respectfully urged that this suggestion be favorably considered during the coming session of the Legislature.

The commission is not always able to do its work in the best and most economical manner on account of the restrictions of section 4, chapter 497 of the Acts of 1894, which, as interpreted by the Attorney-General, forbid the making of contracts for any part of the labor or material necessary to the construction of a highway, allowing only contracts for the entire construction of said State highway.

Experience has shown the great advisability of being able to contract at one time for the grading only, the finishing to be let separately at a later period or in another season. In many localities this sort of construction would produce much better results, and it ought to be possible for the commission to adopt it. Again, it has developed that in many localities the delivery of stone for use in building the road can be contracted for at a much lower rate in the autumn and winter than in the summer, when the actual construction of the highway can be carried on. Farmers and others who engage in the work are often idle during much of the winter; and the interests of all would be greatly furthered by a modification of the statutes, to the end that the commission might use its discretion in dividing the work of road construction, and making contracts in such number as is deemed wise.

The commission is of opinion that chapter 513 of the Acts of 1896, which provided for the purchase of road machinery on the application of the county commissioners of any county, is not a wise measure in its present form, and for that reason no sum has been inserted in the estimates for the purpose of carrying out its provisions.

As it now stands, there is no limit on the number of steam rollers and portable stone crushers for which any town may ask, except that of the amount of the appropriation for their purchase; and the commission has no discretion in the matter of granting such request, when regularly forwarded through the county commissioners. It is impossible to think that this was the intent of the Legislature in passing this act. The law also provides that, while such road machinery shall remain the property of the Commonwealth, it shall be managed and maintained under the direction of the county commissioners. This does not seem wise to the commission, as it throws the care of State property on county authorities, without any proper accountability for the same. If the machinery were to continue under the care of the Highway Commission, it would be more likely to be properly cared for, and, besides, could be utilized, when not needed by town authorities, in the scheme of repairs of State roads which must shortly be put in operation, or in their original construction, when convenient.

A modification of this act, to secure this and to correct the failure in limitation, is much to be desired.

Under the appropriation made in chapter 548, Acts of 1896, of \$12,000 to carry out the provisions of this act, road machinery was purchased and furnished to the several towns as follows:—

One steam roller to each of the following towns: Green-	
field, Westfield, Palmer, Winchester, Natick and Ware,	
at a cost of	\$11,325 00
One portable stone crusher to the town of Palmer, at a cost	
of	637 50
Total,	<u>\$11,962 50</u>
Leaving a balance of \$37.50 unexpended.	

The commission is likely to find itself seriously embarrassed by the interpretation of chapter 541, Acts of 1896, which is an act relative to street railways located on public highways. By this act the commission is given authority to change the location, grade, paving, etc., of street railways, when it becomes necessary, in its opinion, to make such changes in the course of construction of a State highway.

But, if the owners of the railway shall so desire, the cost of making such change must be paid by the Highway Commission, the same to be repaid to the Commonwealth by said owners in ten equal annual instalments, with interest not exceeding four per cent. per annum.

The language of the statute is not clear as to whether this repayment is to become available to the Highway Commission when received by the State treasurer, or is to form a part of the common fund of the State treasury. As money loaned from the fund appropriated for the construction and maintenance of State highways, it would be only just that it should return again to that fund.

A more serious feature of this act is the failure to make permanent the jurisdiction which it temporarily bestows over the grade, location, etc., of street railways. In section 2, chapter 497 of the Acts of 1894, it is distinctly provided that, when a highway has been accepted and constructed as a State road, it shall continue to be maintained by the Commonwealth, under the supervision of the Highway Commission; and that all openings and placing of structures in any such road shall be done in accordance with a permit from said commission. It is elsewhere provided that the Commonwealth shall pay all damages for injuries incurred on such State highway, and it seems clear that it was the intent to give entire jurisdiction to the Commonwealth. It would be singular, indeed, if, after a State road was once completed, town or city authorities could assume jurisdiction over street railways lying within the highway bounds, and give or alter the grades or locations, as they chose. The welfare of the general public requires that there should be no uncertainty about this.

By a resolve approved on April 28, 1896, the Highway Commission is directed to report the probable cost, and such other information as may be obtained in relation thereto, of a State highway between the city of Boston and the city of Salem or the city of Newburyport, over the shore route, so called. This matter has received the special attention of one member of the commission, who was selected to make a detailed examination of the problem, and a report as directed by the act will be made at the proper time as

a separate report of the commission to the next General Court.

In order to obtain full rights over the original location of a highway, and also to secure a juster distribution of the cost of road construction, the commission recommends that towns in which it is proposed to construct highways be given authority to release the State from damages on account of land taken or changes of grade.

In accordance with the provisions of section 5, chapter 497, Acts of 1894, the commission has certified to the Auditor of the State the several amounts to be repaid to the Commonwealth by the counties in which State roads have been built up to the year 1896, the same being one-fourth of the total amount expended in highway construction in each county. The repayments are to be made at the end of six years from the date of the expenditure, or at such earlier date as the county authorities preferred. This plan was fixed upon, after a careful consideration of the subject by the commission, as being more likely to give general satisfaction than any other arrangement.

The total amount thus to be assessed for repayment on account of work done during the first two years of the operation of the commission, 1894 and 1895, is \$159,461.67.

THE EFFECT OF STATE ROADS ON THE DEVELOPMENT OF THE ROAD SYSTEM OF THE COMMONWEALTH.

At the outset of the work of the building of State roads there seemed some reason to fear that the municipalities would decrease their individual endeavors in the direction of better roads. It is a satisfaction to note that this has not been the case. At many points in the State the towns having taken contracts for the construction of State roads have, after the close of their engagements with the commission, proceeded, with the machinery which they had acquired for State work, to build ways on their own account. These additional roads have been patterned on those paid for by the Commonwealth, and are of excellent quality; and we may hope that the habit of road building will be fostered rather than hindered by the State aid.

GRAVEL ROADS.

The experience had in the construction of the gravel road in the town of Hingham, and with the endurance of the weight of traffic, has led the commission to undertake other constructions of this nature. At several points it proposes to begin a State road by the use of gravel as a hardening material, feeling that it may be found, after some years of experience, cheaper to maintain the way in that state. If the experience should not be to this effect, the gravel which has been applied will serve as an excellent foundation for broken stone.

It is believed that, with a well-conditioned gravel road which has been kept in a smooth state, the amount of broken stone required for use will be much less than under the ordinary conditions of construction, where the foundation of the road is not as firm as on a used way which does not have to be regraded.

The commission has also found the advantage of a preliminary construction of roads without any hardening material. On this account it has been determined to construct a considerable portion of the Cape Cod road in the town of Truro without, for the present, hardening any portion of it. This method has the advantage that it at once removes the difficulties, usually the most considerable, which arise from steep grades, thus bettering the condition of traffic, while it leads the way for the consolidation, which may cheapen the cost of hardening by diminishing the amount of broken stone or gravel which has to be used.

THE DISTRIBUTION OF STATE ROADS IN THE COMMONWEALTH.

The selection of roadways which shall be rebuilt as State roads at the expense of the Commonwealth is naturally the most difficult problem with which the commission has to deal. The nature of that problem will be more readily understood after an examination of the map of the State, which forms a part of this report, on which is laid down, in addition to county and town boundaries, the roadways which the commission has been petitioned to take and those

which it has up to this date actually accepted as State roads, nearly all of the latter having been actually constructed.

Under the provisions of the law the commissioners are not permitted to control the expenditure of the appropriation entirely by their own judgment. They are restricted by two provisions, the wisdom of which they do not at all criticise, but which should always be kept in mind in considering the results of their labors. The first of these is that "all constructions of State roads shall be fairly apportioned among the different counties," and in this they have been guided in the main by the relative miles of roadway existing in the several counties. The second is the restriction growing out of the use of the petition. It was obviously the intention of the Legislature to limit the initiative of the Highway Commission in planning for the location of State ways. As is well known, the commission cannot of its own motion accept or reject any route; it has to await the petitions of the municipalities or the county commissioners. The only manner in which it can effect any satisfactory grouping of these petitions, so that continuous routes may come from the constructive work, is by rejecting the petitions which may come to it, or by counselling with the authorities having the right to petition in advance of their formal requests.

In order to keep the State roads from having a total lack of ultimate purpose in their relations to each other in the distribution of the Commonwealth, the commission has been compelled gradually, though not formally, to come to a state of mind as regards the selection of roads which are to be taken. In part this rather undetermined project is indicated by the distribution of the routes which have been accepted, as is shown on the accompanying map. In part, though less distinctly, it is indicated by the direction of the petitions, the greater part of which have been submitted after more or less conference with the commission.

It appears to your commission that the time has now come when some statement, still necessarily tentative, should be made which will set forth in a general way the views of the commission as to the policy to be followed by the Commonwealth in the construction of State roads. This statement is submitted in no sense as a hard-and-fast plan, but in order to

set forth the direction in which the work of the commission is inevitably drifting; and we should hope that this statement may provoke criticism, and, if need be, modification of the action.

It seems, in the first place, clear that the most important of the many needs which are to be met by the construction of State roads is that which relates to the connection of the centres of business in the Commonwealth with each other, in so far as the business relations demand this connection. Thus, where two towns have a large exchange of relations, the way lying through other towns which profit little by the traffic, there is good reason why the State should take charge of the main connecting way.

Closely related to this is the case of a considerable number of smaller, less populous towns, surrounding a large city or centre of dense population, with which they have intimate business relations. It furnishes the market for their products, and the profit to the producer as well as the cost to the consumers is largely determined by the cost of local transportation. Even where facilities for transportation by rail exist, there is still much use of the public highway whenever it is in reasonably good condition. It is in evidence before the commission that many articles of produce, especially perishable and delicate fruits, are preferably sent many miles to the city market in farm wagons, where shipping by rail would be both quicker and cheaper, on account of the better condition in which they may be delivered.

In making its selections among numerous petitions the commission has endeavored to keep in mind the great advantages arising from easy connections between large centres of population and the surrounding agricultural areas, for in so doing the demands of both urban and suburban populations are recognized and their mutual interests promoted.

Another class of cases arises, in which one or more towns lie remote from the rail or water ways, losing opportunities of advancement on account of this hindrance. These conditions are in some cases so grave that the average cost during the year of transporting a ton of freight from a village otherwise well placed for manufacturing to the business centres of the Commonwealth is greater than would be incurred in

transporting the same burden from the central portion of the Mississippi valley to the city of Boston. In these cases, also, the commission feels impelled to better the traffic conditions by improving the way.

In yet other, but not numerous, cases, portions of the States adjacent to this Commonwealth have their natural business centres in some of our cities or towns, but the people thus residing beyond the bounds of the Commonwealth are deterred from seeking access to its markets by the difficulties of the way. In such instances it seems desirable that good roads should be provided to the bounds of the Commonwealth.

The conditions above mentioned may be regarded as of a local character. There remains yet another of such interests of a general nature to be provided for. These will be met by so grouping the State roads that they will in the end afford continuous routes through the Commonwealth, which may serve the interests of pleasure travel or the occasional distant carriage which would be done by ordinary wagons where the roads were good. These extended ways, including in general those which relate to driving for a distance of more than fifteen miles, are of greater importance to the interests of the Commonwealth than might at first sight appear. A considerable part of the present and much of the prospective value of real estate in the Commonwealth, as well as of the traffic which takes place therein, is due to the incoming of people from the central and western parts of the country, who seek summer residences and family homes in the very attractive rural districts of the State. People who thus resort to the Commonwealth for recreation desire opportunities for driving such as would be afforded by a well-organized system of State ways, which would be laid out and beautified with some reference to the natural and historic interests of the country. It is hardly necessary to say that the use of the bicycle for pleasure travel would also be thus accommodated.

Although the commissioners do not propose to build roads which relate only or even mainly to pleasure travel, they feel that the service which can be done by a system which

relates to such travel is so great and of such economic importance to the Commonwealth that it should always be kept in mind.

An examination of the map referred to above will reveal in some degree the groupings of highways up to this time, as indicated by petitions and by acceptance. A few rather long, continuous lines of State highway are apparently demanded at the present time, and their construction ought to be kept in view in the acceptance of petitions; but the commission must not allow itself to be too much influenced by an adjustment of petitions, which often stand only for local interest and activity. While there is often good reason for accepting one highway on account of local conditions, although it may not form a part of any general scheme, and another because it does fit into such a scheme, although of less local value than another which may be near by, there is often equally good reason for postponing action on a third because it is relatively of less *immediate* importance than either of the others.

The commissioners are of opinion that nearly every mile of road thus far petitioned for should some time be built as a State highway; but it is clear that, as only a comparatively small number of miles can be completed annually, some selection must be made.

In choosing which shall be undertaken first, the commissioners must be governed by considerations of the broadest character, many of which will not be evident to those who necessarily think most of local interests. The order of presentation of petitions can have no influence, nor should it be inferred that, because a petition is not granted this year, it may not be next, or the year after. Outside of the limitations put upon them by the statute, the commissioners are bound to exercise their best judgment in all cases; and, while they are likely to be far from infallible, and welcome fair criticism, all who are unselfishly interested in the extension of this important system of State highway construction are likely to accept the judgment as the result of a comprehensive knowledge of the whole situation, growing out of the necessary consideration of the scheme as a whole.

ENGINEERING.

The engineering department was organized with Mr. Charles Mills in charge of all engineering and construction work, with Mr. J. C. S. Taber as assistant engineer in charge of surveying parties and office work and Mr. A. M. Lovis as office assistant.

Messrs. F. C. Pillsbury, W. R. Farrington and W. B. Wheeler have been employed as division engineers. Messrs. H. R. Starbird, H. P. Wires, G. R. Winslow and A. H. Peterson have been employed as chiefs of survey parties, with Messrs. E. N. Colburn, J. M. Kimball, W. A. Grover, H. A. Hall, E. P. McClintock, E. B. Walbridge, N. B. Wilber, J. M. Gilmore and J. F. Osborne as transitmen, and Messrs. J. J. Gleason, E. N. Sampson, F. H. Grover, M. L. Brown, Jr., C. A. Raymond, E. M. Noble and P. H. Belknap as rodmen. Messrs. H. V. Sandford, J. H. Taylor, H. C. Karlson, F. J. Nowell, J. P. Dahlgren, W. H. Sleeper and W. G. Burns have been employed in the draughting room.

ESTIMATES FOR WORK IN 1897.

So far the commissioners have hesitated from year to year to ask any increase in the amount of money placed at their disposal for the construction of State roads. This hesitation has been due to the fact that it was desirable to gain experience in the work, and to build up a small but effective corps of engineers who could be safely trusted with the undertakings. This experience and organization are now so far complete that your commissioners have no hesitation in recommending an appropriation of \$800,000 for the ensuing construction year.

In case the appropriation does not exceed that of the last year, it is doubtful whether the commissioners will find it possible to begin any new constructions. It is likely to appear, on a careful study of the conditions, most desirable to continue the roads now in hand. If, however, the sum of \$800,000 is appropriated, your commissioners estimate that it will be possible to begin new constructions at a considerable number of points in the Commonwealth.

For reasons already given, it is especially urged that the amount estimated for be made available annually for a series of not less than five years.

The commission has endeavored to favor in every way in its power the establishment of crusher plants. It has, therefore, held itself free to give advice to business men who might seek to establish such plants, thereby increasing the opportunities for obtaining broken stone, and it is particularly desirable that such plants should be established on Cape Cod.

One of the members of the commission has given much time to the study of distribution of road-building stones. As a part of the work of this study, careful experiments have been made and are being made as to the strength, cementation of value and other properties of all the varieties of stone which are in use in the Commonwealth. As the road is built it is the intention to have the materials thoroughly tested. These tests, when compared with the cost of repairs, will in the course of a few years begin to give exceedingly valuable information as to the relative utility of the diverse road-building materials which are found within the area of the Commonwealth. In Appendix G of this report will be found an account of the field and laboratory studies of road building in progress under the direction of the commission, and made by Mr. L. W. Page. It is a continuation of that in the report of last year.

The following is a summary of the expenditures of the Highway Commission during the year 1896. Although the statement shows a considerable amount of money unexpended at this date, it is the least amount needed to complete contracts already made and to meet the necessary expenses of the office.

EXPENDITURES OF THE MASSACHUSETTS HIGHWAY COMMISSION
For the Year ending Dec. 31, 1896.

COUNTIES.	Construction.	Repairs and Maintenance.	Totals.
Barnstable,	\$30,591 64	—	\$30,591 64
Berkshire,	32,797 72	\$322 28	33,120 00
Bristol,	46,616 76	235 45	46,852 21
Dukes,	14,494 72	33 84	14,528 56
Essex,	39,507 25	50 50	39,557 75
Franklin,	38,565 58	189 50	38,755 08
Hampden,	30,161 49	1,653 48	31,814 97
Hampshire,	37,112 78	988 64	38,101 42
Middlesex,	41,502 13	66 83	41,568 96
Nantucket,	8,110 02	10 83	8,120 85
Norfolk,	26,006 87	112 20	26,119 07
Plymouth,	39,927 23	415 27	40,342 50
Worcester,	73,186 69	648 37	73,835 06
Totals,	\$458,580 88	\$4,727 19	\$463,308 07

Total for construction, repairs and maintenance,	\$463,308 07
Relocation of street railways (Leicester, 1896, road),	8,136 41
Engineering : —	
Travel, including mileage, board and subsistence,	\$3,950 41
Supplies,	1,407 25
Salaries,	22,021 74
	27,379 40
Salaries of commissioners,	6,000 00
Travel of commissioners,	1,270 69
Clerks and clerical assistance,	6,015 65
Rent of offices to Aug. 1, 1896,	1,875 00
Incidentals : —	
Advertising,	\$236 90
Printing, including postal cards and stamped envelopes,	1,139 62
Amounts carried forward,	\$1,376 52
	\$513,985 22

Amounts brought forward, . . . \$1,376 52 \$513,985 22

Incidentals — *Con.*

Stationery, 191 05

Telephone, including tolls, 242 32

Light, 91 68

Janitor to Aug. 1, 1896, 147 00

Fixtures, including two safes, 645 83

Minor items, including repairs, tele-
grams, express charges, etc., 571 91

3,266 31

Mileage partially used, 560 00

Grand total, \$517,811 53

NOTE. — This year's expenditure includes \$600 in mileage and cash drawn on requisition which appeared in the 1896 report as partially used.

T. C. MENDENHALL,

N. S. SHALER,

W. E. McCLINTOCK,

Massachusetts Highway Commission.

APPENDIX.

APPENDIX A.

REPORT OF CHIEF ENGINEER.

BOSTON, MASS., Dec. 31, 1896.

To the Massachusetts Highway Commission.

GENTLEMEN : — I herewith submit the following report of work performed during the year 1896 : —

The fall of the year 1895 being favorable to out-of-door work, construction was continued until the appropriation made had been practically expended.

As it was necessary for the commissioners to know the amount to be appropriated by the Legislature before the amounts to be allotted for the work in the different municipalities during the year 1896 could be determined, all the lay-outs were necessarily made after such determination, and, the appropriation not having been made by the Legislature until June 4, 1896, it was not until the first of the month of July following that construction work could be begun. As a consequence of this delay, location and construction were in progress at the same time, and a large force of engineers and assistants was necessarily employed. More than two months of the best season for road work having passed before the beginning of new constructions, it was necessary to have the work done in four months, which required a very large addition to the number of resident engineers employed, and but a portion of these men could be advantageously retained during the winter season. If appropriations were passed by the Legislature in season to permit of the work being begun as soon as the weather was favorable, a smaller force of engineers could be used to better advantage.

All the work laid out in the years 1894 and 1895 has been completed, with the exception of a small section in the town of Scituate.

Construction work during the past year has been carried on under 118 different contracts, covering 116 lay-outs, made in 68 different cities and towns.

The following statement shows the amount of work done in 1896 : —

176,634.1 cubic yards of earth excavation.

5,125.14 cubic yards of ledge excavation.

5,275.93 cubic yards of rubble masonry, laid dry.

575.32 cubic yards of rubble masonry, laid in cement.
 43,521.88 cubic yards of gravel.
 21,941.91 square yards of telford.
 530,809.3 square yards of shaping for broken stone.
 146,068.75 tons of broken stone.
 9,514.70 lineal feet of vitrified clay pipe, exclusive of side drains.
 70,149.4 lineal feet of guard rail.
 34,058 lineal feet of side drains.
 14,017 square yards of cobble-stone gutters.
 1,322 stone monuments set.

STATEMENT OF APPROPRIATION AND EXPENDITURES FOR 1896.

The Legislature of 1896 appropriated \$600,000.

Amounts expended in each county for road construction during the year ending Dec. 31, 1896, including salaries of resident engineers, survey work done after signing of contracts, cost of stone bounds and other items properly charged to the roads : —

Barnstable County,	\$80,591 64
Berkshire County,	32,797 72
Bristol County,	46,616 76
Dukes County,	14,494 72
Essex County,	39,507 25
Franklin County,	38,565 58
Hampden County,	30,161 49
Hampshire County,	37,112 78
Middlesex County,	41,502 13
Nantucket County,	8,110 02
Norfolk County,	26,006 87
Plymouth County,	39,927 23
Worcester County,	73,186 69
Total,	<hr/> \$458,639 38
Expended for surveys, including travel of engineers, not charged to construction accounts, instruments, etc.,	<hr/> 27,379 40
Total,	<hr/> \$485,960 25

MAINTENANCE AND REPAIRS.

The amount expended in maintenance (\$4,727.19) has for the most part been because of damages caused by spring freshets, the most notable being those caused at Westfield, Russell and Huntington, by the overflow of the Westfield River, and at Hadley, by the overflow of the Connecticut River.

The expense of repairs has been mostly confined to the cleaning of gutters and the filling in of gullies formed in the slopes by the flow of surface water. The seeding of the slopes will obviate most of the repairs of this nature.



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Another important outlay in the maintenance account has been brought about by the tendency to travel in one track. This has caused, in many places, a single line of the road to be worn for a width of one and one-half to two feet; it has been necessary to fill these depressions with broken stone. In order to call the attention of the drivers to the damage caused by driving in the centre of the way there have been placed on a number of roads signs requesting that the driving be not confined to the middle of the road, and as a result it is found in a great number of cases that the travel has been spread over the surface of the roadway in a satisfactory manner.

WIDTH OF 'TRAVELLED WAY.

As much criticism has been made concerning the width of the travelled way covered with broken stone, I have had the widths ordinarily travelled taken on the following roads, a study of which will show that the proportion of the roadway travelled to the portion constructed has been largely over-estimated. The width graded on all roads undertaken, with the exception of two, viz., Truro and West Tisbury, has not been less than twenty-one feet. The widths given in the following table are in feet. In each case, in addition to the width of the macadam, there is a shoulder at least three feet in width, built of gravel or broken stone, and rolled by a steam roller, on each side of the macadam, and in many cases it exceeds three feet in width.

The following table will show the width of the macadam, the entire width of the travelled way, and the width of the commonly travelled portion on the various roads in the different cities and towns: —

TOWN OR CITY.	County.	Width of Macadam.	Maximum Width of Travelled Way.	Width of Commonly Travelled Way.
Andover, . . .	Essex, . . .	18	24	24
Ashby, . . .	Middlesex, . . .	20-15	12	9
Athol, . . .	Worcester, . . .	17	16	10-12
Auburn, . . .	Worcester, . . .	15	12	9
Beverly, . . .	Essex, . . .	18	20-24	20
Buckland, . . .	Franklin, . . .	24-15	10	7-9
Dalton, . . .	Berkshire, . . .	15	20	20
Deerfield, . . .	Franklin, . . .	15	12-14	11

TOWN OR CITY.	County.	Width of Macadam.	Maximum Width of Travelled Way.	Width of Commonly Travelled Way.
Duxbury, . . .	Plymouth, . . .	15	12-14	7
Easthampton, . . .	Hampshire, . . .	15	12-13	9-10
Fitchburg, . . .	Worcester, . . .	15	15	10
Gloucester, . . .	Essex, . . .	15	15	15
Goshen, . . .	Hampshire, . . .	15	10	7
Granby, . . .	Hampshire, . . .	15	9	5
Hadley, . . .	Hampshire, . . .	15	15-18	10
Hingham, . . .	Plymouth, . . .	15	17	10
Holden, . . .	Worcester, . . .	18-15	13-18	10
Huntington, . . .	Hampshire, . . .	15	9	7
Lee, . . .	Berkshire, . . .	24-15	21-15	12-15
Leicester, . . .	Worcester, . . .	24-15	15	10-12
Lexington, . . .	Middlesex, . . .	15	15-20	15
Lincoln, . . .	Middlesex, . . .	15	15	10
Marion, . . .	Plymouth, . . .	15	15	10
Marshfield, . . .	Plymouth, . . .	15	14	8
Middleborough, . . .	Plymouth, . . .	15	25-30	20-25
Monson, . . .	Hampden, . . .	15	12	8-10
Nantucket, . . .	Nantucket, . . .	15	—	—
Newburyport, . . .	Essex, . . .	15	15	8-10
North Adams, . . .	Berkshire, . . .	15	10-12	8-10
Norfolk, . . .	Norfolk, . . .	15	10	10
North Attleborough, . . .	Bristol, . . .	24-15	15-20	10-15
Northampton, . . .	Hampshire, . . .	20	18	12
Norwood, . . .	Norfolk, . . .	15	18	10-15
Orange, . . .	Franklin, . . .	17	16	10-12
Paxton, . . .	Worcester, . . .	15	13	9
Plymouth, . . .	Plymouth, . . .	15	15	9
Rehoboth, . . .	Bristol, . . .	15	9	9
Russell, . . .	Hampden, . . .	15	8-10	7
Scituate, . . .	Plymouth, . . .	15	14	8
Shelburne, . . .	Franklin, . . .	18-15	12-15	8
Shrewsbury, . . .	Worcester, . . .	18-15	18-12	12-7
Somerset, . . .	Bristol, . . .	15	15	9
South Hadley, . . .	Hampshire, . . .	15	15	10
Taunton, . . .	Bristol, . . .	15	20	10-15

TOWN OR CITY.	County.	With of Macadam.	Maximam Width of Travelled Way.	Wldth of Commonly Travelled Way.
Tyngsborough, .	Middlesex, . .	15	10	10
Walpole, . . .	Norfolk, . . .	15	15	8
Warren, . . .	Worcester, . .	15	18	7
Watertown, . .	Middlesex, . .	27	33	25-30
Westfield, . .	Hampden, . . .	18-15	13	9
Westminster, .	Worcester, . .	15	15	9
West Newbury, .	Essex,	15	14	8
Westport, . . .	Bristol,	18	14	14
West Springfield, .	Hampden, . . .	18	15-12	10
Weymouth, . . .	Norfolk,	15	21	21
Whitman,	Plymouth, . . .	18	15	11
Wilbraham, . . .	Hampden,	15	8-9	7
Williamstown, . .	Berkshire, . . .	15	10-12	9
Average, . . . .	. . . . .	16.10	14.92	11.05

All of which is respectfully submitted,

CHAS. MILLS,
Chief Engineer.

Dennis, 1896,	53	Town,	25	-	-	-	-	-	-	1 75	2 50	4 00	60	33	02	1 53	-	60	15	30	65	1 25
Dennis, 1896,	161	Town,	30	-	-	-	-	-	-	1 75	2 50	4 00	50	33	02	1 53	-	60	15	30	65	1 25
Duxbury, 1894,	33	Town,	25	-	-	-	-	-	-	1 75	2 50	-	50	33	-	1 47	-	60	10	25	70	1 00
Duxbury, 1895,	50	Town,	25	-	-	-	-	-	-	1 75	2 50	4 00	50	33	02	1 52	-	60	15	25	70	1 00
Easthampton, 1895,	83	Town,	35	-	-	-	-	-	-	1 75	3 00	5 00	50	30	02	-	51 68	60	15	33	50	1 50
Easthampton, 1896,	125	Town,	35	-	-	-	-	-	-	1 75	3 00	5 00	75	30	02	-	51 58	60	15	33	50	1 50
Fairhaven, 1894,	21	Town,	27	-	-	-	-	-	-	-	2 50	-	-	-	-	1 40	-	60	12	25	70	1 00
Fairhaven, 1895,	64	Town,	35	-	-	-	-	-	-	1 75	2 50	5 00	-	-	-	1 45	-	60	15	33	50	1 50
Fitchburg, 1894,	4	City,	25	-	-	-	-	-	-	-	2 00	-	50	25	-	-	1 83	60	10	25	-	1 00
Fitchburg, 1895,	100	City,	30	-	-	-	-	-	-	1 75	2 00	2 50	50	30	02	-	2 00	60	15	-	50	1 00
Gloucester, 1894,	39	City,	50	-	-	-	-	-	-	1 75	2 50	-	60	33	-	1 24	-	60	12	25	65	1 50
Gloucester, 1896,	147	T. Stuart & Son,	30	-	-	-	-	-	-	1 50	3 50	4 50	-	-	05	1 40	-	-	20	-	50	5 00
Goshen, 1894,	10	Town,	30	-	-	-	-	-	-	1 75	2 50	-	50	25	-	1 53	-	65	910	25	75	1 25
Goshen, 1895,	84	Town,	40	-	-	-	-	-	-	1 75	2 50	4 50	50	35	02	1 75	-	60	15	35	60	1 50
Granby, 1894,	31	Town,	30	-	-	-	-	-	-	1 75	2 50	-	80	33	-	-	2 85	60	12	35	-	1 00
Gt. Barrington, 1894,	23	Town,	25	-	-	-	-	-	-	1 75	2 50	-	60	33	-	-	2 20	60	12	25	70	1 25
Gt. Barrington, 1896,	162	Town,	30	-	-	-	-	-	-	1 75	3 00	6 00	50	33	02	-	-	60	15	35	-	1 50
Hadley, 1894,	15	Town,	30	-	-	-	-	-	-	-	-	-	50	33	-	-	-	-	12	25	-	75
Hadley, 1895,	74	Town,	30	-	-	-	-	-	-	-	3 00	5 00	60	-	-	-	1 93	-	15	-	-	1 25
Hadley, 1896,	135	Town,	30	-	-	-	-	-	-	1 75	3 00	5 00	60	-	-	-	2 00	60	15	-	-	1 25
Hancock, 1895,	97	Hendrick, Tay- lor & Warner,	30	-	-	-	-	-	-	2 00	4 00	-	-	-	-	-	-	53	1215	19	-	50
Hingham, 1894,	126	Town,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hingham, 1896,	149	Town,	50	-	-	-	-	-	-	1 75	3 00	6 00	75	35	02	1 41	-	60	15	35	65	1 25
Holbrook, 1896,	173	Duncan Rusk,	23	-	-	-	-	-	-	1 50	142 60	5 00	42	41	-	-	-	55	15	26	50	1 25
Holbrook-Weymouth, 1894,	90	W. T. Davis,	43	-	-	-	-	-	-	1 50	3 50	-	-	-	-	-	-	50	15	-	-	1 00
Holden, 1894,	16	Town,	35	-	-	-	-	-	-	1 75	2 50	-	50	35	-	1 57	-	-	-	25	50	1 00
Holden, 1895,	75	Town,	35	-	-	-	-	-	-	1 75	2 50	5 00	65	33	02	1 56	-	60	15	33	50	1 50
Holden, 1896,	163	Town,	35	-	-	-	-	-	-	1 75	2 50	5 00	50	33	02	1 55	-	60	15	33	50	1 50
Huntington, 1895,	55	Town,	30	-	-	-	-	-	-	1 50	2 50	4 50	40	25	02	-	1 84	60	14	33	50	1 00
Huntington, 1896,	127	Town,	30	-	-	-	-	-	-	1 50	2 50	4 50	40	25	02	-	1 75	60	15	33	50	1 00

¹ Borrow. ² Red granite. ³ Local trap. ⁴ Lower course red granite. ⁵ Also beach stone for foundation, 90 cents per ton. ⁶ Sand.
⁷ Opening 3 feet or less. ⁸ Unpainted. ⁹ Painted. ¹⁰ Screened. ¹¹ Also top rail for fencing, 4 cents per linear foot.
¹² Lump sum; gravel road. ¹³ Also moving and rebuilding common wall, \$1.25 per rod. ¹⁴ Different haul.

CONTRACT PRICES ON STATE ROADS, ETC. — Continued.

TOWN OR CITY.	Number of Con- tract.	Contractor.	EXCAVATION.						RUBBLE MASONRY.		Gravel.	Telford.	Shapling.	BROKEN STONE.		Vitrified Clay Pipe, 12 Inch.	Fencing.	Side Drains.	Cobble Gutters.	Bounds.	
			All Kinds.	Surface Grading.	Sand.	Gravel.	Hard-pan.	Clay.	Ledge Excava- tion.	Dry.				Cement.							
											Cubic Yard.	Cubic Yard.	Cubic Yard.		Cubic Yard.	Cubic Yard.	Cubic Yard.	Cubic Yard.	Cubic Yard.	Sq. Yard.	Sq. Yard.
Lawrence, 1896,	176	City,	\$0 50	-	-	-	-	-	\$1 75	\$3 00	\$5 00	\$0 60	\$0 33	\$0 02	-	\$1 60	\$0 60	\$0 15	\$0 35	\$0 60	\$1 25
Lee, 1894, . . .	20	Town,	30	\$0 30	-	-	-	-	1 50	12 50	-	65	35	-	1 70	60	12	25	-	-	1 25
Lee, 1895, . . .	54	Town,	35	-	-	-	-	-	1 75	24 50	5 00	45	33	02	-	-	60	15	35	60	1 35
Lee, 1896, . . .	99	F. T. Ley & Co.,	25	-	-	-	-	-	-	3 50	3 50	35	-	02	-	-	-	-	-	35	1 00
Leicester, 1894, .	150	Town,	35	-	-	-	-	-	1 75	2 50	-	1 00	25	05	-	1 37	-	12	25	60	-
Leicester, 1895, .	5,24,	Town,	-	-	-	-	-	-	1 75	2 50	4 00	65	30	02	1 43	60	-	25	25	60	1 50
Leicester, 1896, .	42,	Town,	35	-	-	-	-	-	1 75	2 50	4 00	1 00	35	02	1 53	60	-	25	25	60	1 65
Lexington, 1896,	119	Town,	-	-	-	-	-	-	1 75	2 50	5 00	60	33	02	1 55	60	15	35	60	60	1 50
Lexington, 1896,	66	Town,	-	-	-	-	-	-	1 75	2 50	5 00	60	33	02	1 50	60	15	35	60	60	1 50
Lexington, 1896,	110	Town,	-	-	-	-	-	-	1 75	2 50	5 00	40	30	02	1 40	60	15	35	60	60	1 50
Lincoln, 1896, .	65	Town,	35	-	-	-	-	-	1 75	2 50	4 50	50	30	02	1 45	60	15	33	60	60	1 25
Lincoln, 1896, .	115	Town,	-	-	-	-	-	-	1 75	2 50	4 50	50	30	02	1 45	60	12	-	-	50	1 75
Marion, 1894, . .	3	Town,	25	25	-	-	-	-	-	2 50	-	50	-	-	1 45	-	-	-	-	-	-
Marion, 1895, . .	67	Town,	-	-	-	-	-	-	1 75	2 50	5 00	75	30	02	1 45	60	15	33	60	60	1 50
Marshfield, 1894,	28	Town,	25	25	-	-	-	-	1 75	2 50	-	50	33	-	1 47	60	10	25	70	70	1 00
Marshfield, 1896,	128	Town,	30	-	-	-	-	-	1 75	3 00	5 00	50	33	02	1 70	60	15	30	65	65	1 50
Mattapoisett, 1894,	19	Town,	25	-	-	-	-	-	-	2 50	-	-	33	-	1 30	60	12	25	-	-	1 00
Mattapoisett, 1895,	76	Town,	35	-	-	-	-	-	1 75	2 50	5 00	50	30	02	1 25	60	15	33	50	50	1 50
Methuen, 1896, .	177	Town,	35	-	-	-	-	-	1 75	3 00	5 00	50	35	02	1 50	60	15	35	60	60	1 25
Middleborough, 1894,	29	Town,	30	30	-	-	-	-	1 75	2 50	-	50	33	-	1 47	60	12	25	65	65	1 25
Middleborough, 1895,	51	Town,	25	-	-	-	-	-	1 75	2 50	4 00	50	33	02	1 28	60	15	25	65	65	1 25
Middleboro', 1896,	126	Town,	30	-	-	-	-	-	1 75	3 00	5 00	50	33	02	1 38	60	-	-	-	65	1 25
Middleboro', 1896,	136	Town,	30	-	-	-	-	-	1 75	2 50	4 50	35	33	02	1 18	60	12	25	75	75	1 00
Monson, 1894, . .	52	Town,	20	-	-	-	-	-	-	-	-	71 50	-	-	-	-	-	-	-	-	75
Nantucket, 1894,	9	Town,	20	-	-	-	-	-	-	-	-	71 50	-	-	-	-	-	-	-	-	75
Nantucket (1), 1895,	85	Town,	20	-	-	-	-	-	-	-	5 00	71 75	-	-	-	-	15	-	-	50	1 25

Nantucket (2), 1895, .	107	Town, .	20	-	-	-	-	-	-	5 00	71 75	-	02	-	03 00	60	15	-	50	1 25
Nantucket (1), 1896, .	131	Town, .	20	-	-	-	-	-	-	-	71 75	-	02	-	03 06	-	-	-	70	1 50
Nantucket (2), 1896, .	175	Town, .	20	-	-	-	-	-	-	6 00	-	-	02	-	-	70	-	-	70	1 50
Newburyport, 1896, .	167	C. H. Kelleher, .	25 } 50 }	-	-	-	-	-	-	3 00	50	-	02	1 35	-	50	19	30	50	1 00
North Adams, 1894, .	40	City, .	25	-	-	-	-	-	-	-	60	33	-	-	1 92	60	12	25	70	1 25
North Adams, 1896, .	151	M. R. Flak, .	25	-	-	-	-	-	-	-	40	-	02	-	1 90	-	15	-	-	1 25
Northampton, 1894, .	12	City, .	30	-	-	-	-	-	-	-	-	-	-	1 67	-	-	-	-	-	-
North Attleborough, 1894, .	8	Town, .	30	-	-	-	-	-	-	-	-	-	-	1 06	-	55	-	-	-	-
North Attleborough, 1895, .	77	Town, .	35	-	-	-	-	-	-	5 00	50	30	02	1 37	-	60	15	33	-	1 50
North Attleborough, 1896, .	157	Town, .	-	-	-	-	-	-	-	7 00	75	35	02	-	-	60	15	35	-	1 50
Norfolk, 1895, .	93	Hendrick, Taylor & Warner, .	-	-	-	-	-	-	-	6 00	-	-	-	-	-	60	20	-	-	1 00
Norfolk, 1895, .	164	Town, .	28	-	-	-	-	-	-	-	50	35	02	1 50	-	-	-	35	65	-
Norwood, 1895, .	102	Town, .	35	-	-	-	-	-	-	5 00	60	35	02	1 56	-	60	15	35	60	1 25
Norwood, 1896, .	132	Town, .	-	-	-	-	-	-	-	5 00	75	35	02	1 61	-	60	15	35	60	1 25
Orange, 1894, .	32 }	Town, .	25	-	-	-	-	-	-	4 00	40	33	02	1 59	2 12	60	12	25	70	1 25
Orange, 1895, .	56 }	Town, .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paxton (1), 1895, .	41	Town, .	35	-	-	-	-	-	-	2 50	75	30	-	1 30	-	60	13	30	65	1 50
Paxton (2), 1895, .	62	Town, .	35	-	-	-	-	-	-	4 50	65	30	02	1 40	-	60	15	30	65	1 50
Paxton, 1896, .	111	Town, .	-	-	-	-	-	-	-	4 50	70	30	02	1 39	-	60	15	30	65	1 50
Pittsfield, 1894, .	17	City, .	25	-	-	-	-	-	-	-	50	33	-	-	1 88	60	12	25	-	1 00
Plymouth, 1894, .	35	Town, .	25	-	-	-	-	-	-	-	50	33	-	1 82	-	60	12	25	-	1 25
Plymouth, 1895, .	43	Town, .	25	-	-	-	-	-	-	5 00	50	-	02	1 44	-	60	12	-	60	1 25
Plymouth (1), 1896, .	174	Andrew Carberry, .	17	-	-	-	-	-	-	3 50	-	-	-	-	-	60	15	-	45	90
Plymouth (2), 1896, .	178	J. A. Whittemore's Sons, .	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rehoboth, 1895, .	86	Town, .	35	-	-	-	-	-	-	5 00	55	30	02	1 48	-	60	15	33	60	1 50
Rehoboth, 1896, .	116	Town, .	30	-	-	-	-	-	-	5 00	50	30	02	1 38	-	60	15	33	60	1 50
Russell, H., 1894, .	11	Town, .	30	-	-	-	-	-	-	-	40	25	-	-	2 00	-	12	27	75	1 50
Russell, F., 1894, .	22	Town, .	30	-	-	-	-	-	-	-	40	25	-	-	2 00	-	12	27	75	1 50
Russell, H., 1895, .	58	Town, .	30	-	-	-	-	-	-	4 50	40	25	02	-	2 00	60	14	33	50	1 50
Russell, W., 1896, .	120	Town, .	30	-	-	-	-	-	-	5 00	60	33	-	-	-	60	15	33	60	1 50
Russell, F., 1896, .	158	Town, .	35	-	-	-	-	-	-	5 00	60	33	-	-	-	60	15	33	60	1 50
Scituate, 1894-5, .	68	Town, .	35	-	-	-	-	-	-	4 50	40	30	02	-	101 85	60	15	33	50	1 25

¹ Opening 3 feet or less. ² Opening more than 3 feet. ³ Included in shapings.
⁴ Also moving and resetting common wall, \$2.50 per rod; face wall, \$3.50 per rod. ⁵ Tallings. ⁶ Local trap.
⁷ Screened. ⁸ Limestone from Tompkins Cove. ⁹ Borrow. ¹⁰ Red granite.

CONTRACT PRICES ON STATE ROADS, ETC. — *Concluded.*

RUBBLE MASONRY.												D7.		Cement.		Shaping.		Cobble Gutters.		Bounds.
165	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
36	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
57	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
117	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
78	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
131	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
69	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
152	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
153	Town.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
153	F. T. Lay & Co.,	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
91	Taunton, 1895.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
121	Taunton, 1894.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
7	Tisbury, 1894.	1.75	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
171	F. E. Ellis, Townsend, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
170	Truro, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
101	Tyngaboro', 1895.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
87	Town.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
164	Tyngaborough, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
30	Walpole, 1894.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
140	J. B. Lane & Walpole, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
113	Wareham, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
141	Warren, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
80	Watertown, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
143	Watertown, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
6	Westfield, 1894.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00
159	Westfield, 1896.	1.15	2.50	4.50	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00

12	Town,	25	30	1 75	2 50	5 00	50	25	02	03	1 92	00	20	25	1 10
69	Town,	35	-	1 75	2 50	5 00	50	35	02	02	1 94	00	15	30	1 10
145	Town,	30	-	1 75	3 00	5 00	50	30	02	02	-	00	14	30	1 25
168	Ans Goddard,	35	-	-	3 00	5 00	-	35	02	02	-	00	16	-	-
98	C. H. Kelleher,	22	-	1 40	2 70	3 25	00	02	02	02	1 35	05	19	30	1 00
106	T. Stuart & Son,	30	-	1 50	4 50	4 50	55	30	02	02	1 05	50	-	00	2 50
34	Town,	25	35	1 75	2 50	-	47	33	02	02	1 41	80	12	25	1 25
144	Town,	40	-	1 75	3 50	5 00	65	33	02	02	1 49	00	15	32	1 50
104	Town,	30	-	1 75	3 00	5 00	40	35	02	02	-	00	15	25	1 25
166	Town,	30	-	1 75	3 00	5 00	40	35	02	02	1 52	00	15	25	1 25
46	Town,	30	25	1 75	3 50	4 00	-	26	02	02	1 70	00	16	25	1 25
120	Town,	35	30	1 75	2 50	4 00	-	25	02	02	1 70	00	16	25	1 25
69	Town,	35	-	1 75	3 00	5 00	40	30	02	02	-	00	15	33	1 50
138	Town,	35	-	1 75	3 00	5 00	40	33	02	02	2 10	00	15	33	1 50
37	Town,	40	40	1 75	3 50	-	16	30	02	02	2 02	00	12	25	1 50
94	Town,	40	-	1 75	3 00	5 00	50	30	02	02	-	00	16	32	1 50
113	Town,	40	-	1 75	3 00	5 00	55	30	02	02	-	00	15	32	1 50
106	M. E. Fisk,	37	-	1 75	3 50	4 50	35	-	02	02	2 00	00	15	32	1 25
142	W. N. Fyatt	-	-	-	-	-	-	-	02	02	-	-	12	-	1 25
Granite Co.,	-	-	-	-	-	-	-	-	02	02	-	-	15	-	1 50
240	Town,	35	-	1 75	2 50	5 00	25	35	02	02	1 51	00	12	35	1 50
81	Town,	35	-	1 75	2 50	5 00	05	33	02	02	-	00	15	33	1 50
139	Town,	35	-	1 75	3 00	5 00	70	33	02	02	-	00	15	33	1 50
122	City,	35	-	1 75	2 50	5 00	00	30	02	02	1 35	00	15	30	1 50
18	Town,	30	30	1 75	3 50	-	50	24	02	02	1 45	00	13	25	1 00
61	Town,	40	-	1 75	2 75	4 50	00	33	02	02	1 70	00	15	30	1 25
38	Town,	25	30	1 75	3 50	-	50	-	02	02	1 38	00	12	75	1 00
60	Town,	25	-	1 75	3 00	4 50	11	00	02	02	1 59	00	15	60	1 25
92	Town,	25	-	1 75	3 50	-	80	-	02	02	2 11	00	12	-	75
114	Town,	40	-	1 75	3 00	5 00	11	00	02	02	-	00	17	-	1 00
156	-	25	-	1 75	-	5 00	60	-	02	02	2 00	00	16	-	1 25

¹ Red granite. ² Also wall masonry, \$3.50 per cubic yard. ³ Local trap. ⁴ Stripping and replacing old macadam, 90 cents per cubic yard.
⁵ Also brick or stone catch-basins, \$16 each. ⁶ Grubbing, \$100. ⁷ ⁸ of the State.
⁹ Grubbing, \$600. ¹⁰ Not trap; granite from quarry. ¹¹ Long haul, 50 cents | over 6 feet.
bed.

APPENDIX D.

LIST OF COMPLETED ROADS, SHOWING DATES OF
FINAL ACCEPTANCE OF WORK DONE UNDER
CONTRACTS FOR CONSTRUCTION.

CITY OR TOWN.	Date of Lay-out.	Number of Contract.	Contractor.	Date of Acceptance of Work.
Ashby, . . .	1894	2	Town, . . .	Aug. 6, 1896.
Ashby, . . .	1895	49	Town, . . .	Aug. 6, 1896.
Auburn, . . .	1895	71	Town, . . .	Aug. 6, 1896.
Beverly, . . .	1895	106	City, . . .	Nov. 19, 1896.
Brewster, . . .	1895	82	Town, . . .	Nov. 19, 1896.
Brewster, . . .	1896	124	Town, . . .	Nov. 19, 1896.
Buckland, . . .	1894	27	Town, . . .	Aug. 6, 1896.
Cottage City, . . .	1894	14	Town, . . .	Aug. 6, 1896.
Deerfield, . . .	1894	108	Town, . . .	Nov. 28, 1896.
Deerfield, . . .	1895	73	Town, . . .	Aug. 6, 1896.
Dennis, . . .	1895	53	Town, . . .	Nov. 19, 1896.
Duxbury, . . .	1894	33	Town, . . .	Aug. 6, 1896.
Duxbury, . . .	1895	50	Town, . . .	Aug. 6, 1896.
Easthampton, . . .	1895	83	Town, . . .	Nov. 28, 1896.
Easthampton, . . .	1896	125	Town, . . .	Nov. 28, 1896.
Fairhaven, . . .	1894	21	Town, . . .	Aug. 6, 1896.
Fairhaven, . . .	1895	64	Town, . . .	Aug. 6, 1896.
Fitchburg, . . .	1894	4	City, . . .	June 18, 1895.
Gloucester, . . .	1894	39	City, . . .	Aug. 6, 1896.
Goshen, . . .	1894	10	Town, . . .	Aug. 6, 1896.
Granby, . . .	1894	31	Town, . . .	Aug. 6, 1896.
Great Barrington, . . .	1894	23	Town, . . .	Aug. 6, 1896.
Hadley, . . .	1894	15	Town, . . .	Aug. 6, 1896.
Hadley, . . .	1895	74	Town, . . .	Aug. 6, 1896.
Hadley, . . .	1896	135	Town, . . .	Nov. 28, 1896.
Hancock, . . .	1895	97	Hendrick, Taylor & Warner.	Oct. 22, 1896.
Hingham, . . .	1894	26	Town, . . .	Aug. 6, 1896.
Holden, . . .	1894	16, 25	Town, . . .	Aug. 6, 1896.
Holden, . . .	1895	75	Town, . . .	Aug. 6, 1896.
Lee, . . .	1894	20, 54	Town, . . .	Aug. 6, 1896.
Lee, . . .	1895	99	Town, . . .	Aug. 6, 1896.
Leicester, . . .	1894	5, 24, 42	Town, . . .	Aug. 6, 1896.
Lincoln, . . .	1895	65	Town, . . .	Aug. 6, 1896.
Marion, . . .	1894	3	Town, . . .	Aug. 6, 1896.
Marshfield, . . .	1894	28	Town, . . .	Aug. 6, 1896.
Mattapoissett, . . .	1894	19	Town, . . .	Aug. 6, 1896.
Mattapoissett, . . .	1895	76	Town, . . .	Aug. 6, 1896.
Middleborough, . . .	1894	29	Town, . . .	Aug. 6, 1896.
Monson, . . .	1894	52	Town, . . .	Aug. 6, 1896.
Nantucket, . . .	1894	9	Town, . . .	July 23, 1896.
Nantucket, . . .	1895	85, 107	Town, . . .	July 23, 1896.

LIST OF COMPLETED ROADS, ETC. — *Concluded.*

CITY OR TOWN.	Date of Lay-out.	Number of Contract.	Contractor.	Date of Acceptance of Work.
North Adams, . . .	1894	40	Town, . . .	Aug. 6, 1896.
North Attleborough, . . .	1894	8	Town, . . .	Aug. 6, 1896.
North Attleborough, . . .	1895	77	Town, . . .	Aug. 6, 1896.
Norfolk, . . .	1895	93	Hendrick, Taylor & Warner.	Nov. 12, 1896.
Northampton, . . .	1894	12	City, . . .	Nov. 28, 1896.
Paxton, . . .	1895	62	Town, . . .	Aug. 6, 1896.
Pittsfield, . . .	1894	17	City, . . .	Aug. 6, 1896.
Plymouth, . . .	1894	35	Town, . . .	Aug. 6, 1896.
Plymouth, . . .	1895	43	Town, . . .	Aug. 6, 1896.
Russell (Fairfield), . . .	1894	22	Town, . . .	Aug. 6, 1896.
Russell (Huntington), . . .	1894	11	Town, . . .	Aug. 6, 1896.
Shelburne, . . .	1894	36	Town, . . .	Aug. 6, 1896.
Shelburne, . . .	1895	57	Town, . . .	Aug. 6, 1896.
Taunton, . . .	1895	91	City, . . .	Aug. 6, 1896.
Tisbury, . . .	1894	7	Town, . . .	Aug. 6, 1896.
Walpole, . . .	1894	30	Town, . . .	Aug. 6, 1896.
Westfield, . . .	1894	6	Town, . . .	Aug. 6, 1896.
Westfield, . . .	1896	159	Town, . . .	Dec. 17, 1896.
Westminster, . . .	1894	13	Town, . . .	Aug. 6, 1896.
West Newbury, . . .	1895	98	C. H. Kelleher, . . .	Aug. 6, 1896.
West Springfield, . . .	1895	104	Town, . . .	Nov. 19, 1896.
West Springfield, . . .	1896	166	Town, . . .	Nov. 19, 1896.
Wilbraham, . . .	1895	105	Myron R. Fisk, . . .	July 16, 1896.
Wrentham, . . .	1894	18	Town, . . .	Aug. 6, 1896.
Wrentham, . . .	1895	61	Town, . . .	Aug. 6, 1896.
Yarmouth (North), . . .	1894	38	Town, . . .	Aug. 6, 1896.
Yarmouth (North), . . .	1895	60	Town, . . .	Aug. 6, 1896.
Yarmouth (South), . . .	1895	92	Town, . . .	Oct. 22, 1896.

APPENDIX E.

TABLE SHOWING TOWNS AND CITIES IN WHICH WORK HAS BEEN DONE DURING THE YEAR
1896, THE RESIDENT ENGINEERS ON SUCH WORK, TOGETHER WITH DATES OF BEGINNING
AND ENDING OF WORK.

		Date of Beginning.		Date of Ending.	
Andover,	Essex,	1896	Manwell, F. P.,	Oct. 27, 1896,	Dec. 19, 1896.
Ashby, .	Middlesex,	1895	Wheeler, R. C.,	May 27, 1896,	June 4, 1896.
Ashby, .	Middlesex,	1896	Wheeler, R. C.,	June 19, 1896,	July 14, 1896.
Ashby, .	Middlesex,	1896	Clark, W. L.,	July 14, 1896,	Nov. 30, 1896.
Athol, .	Worcester,	1895	Belknap, F. W.,	June 23, 1896,	Aug. 22, 1896.
Athol, .	Worcester,	1896	Lyman, A. F.,	Oct. 26, 1896,	Nov. 18, 1896.
Athol, .	Worcester,	1895	Wheeler, W. B.,	Nov. 19, 1896,	Dec. 7, 1896.
Athol, .	Worcester,	1896	Belknap, F. W.,	Aug. 22, 1896,	Oct. 21, 1896.
Athol, .	Worcester,	1896	Lyman, A. F.,	Oct. 26, 1896,	Nov. 18, 1896.
Athol, .	Worcester,	1896	Wheeler, W. B.,	Nov. 19, 1896,	Dec. 14, 1896.
Auburn, .	Worcester,	1895	Johnston, J. A.,	May 18, 1896,	July 3, 1896.
Auburn, .	Worcester,	1896	Everett, P. H.,	Sept. 23, 1896,	Nov. 23, 1896.
Beverly, .	Essex,	1895	Foster, E. S.,	June 15, 1896,	Oct. 7, 1896.
Brewster, .	Barnstable,	1895	Maynard, G. F.,	June 8, 1896,	Aug. 1, 1896.
Brewster, .	Barnstable,	1896	Maynard, G. F.,	Aug. 1, 1896,	Aug. 28, 1896.
Brewster, .	Barnstable,	1896	Farrington, W. R.,	Aug. 29, 1896,	Sept. 5, 1896.
Buckland, .	Franklin,	1895	Wood, G. W.,	June 22, 1896,	Nov. 14, 1896.
Buckland, .	Franklin,	1896	Wood, G. W.,	Oct. 19, 1896,	Dec. 5, 1896.
Cottage City, .	Dukes, .	1895	Crowell, J. H.,	June 22, 1896,	Oct. 3, 1896.
Cottage City, .	Dukes, .	1896	Crowell, J. H.,	July 17, 1896,	Sept. 26, 1896.

Dalton, .	.	.	.	.	.	Berkshire,	1895	Jones, L. H., .	.	Aug.	2, 1895,	June 15, 1896,	Nov.	14, 1896.
Dalton, .	.	.	.	.	.	Berkshire,	1896	Jones, L. H., .	.	July	16, 1896,	Aug. 14, 1896,	Nov.	20, 1896.
Deerfield,	.	.	.	.	.	Franklin,	1894	Litchfield, S., .	.	June	18, 1896,	July 15, 1896,	Oct.	6, 1896.
Deerfield,	.	.	.	.	.	Franklin,	1895	Belknap, F. W.,	.	Aug.	8, 1895,	May 27, 1896,	June	5, 1896.
Dennis, .	.	.	.	.	.	Barnstable,	1895	Norton, C. H.,	.	July	11, 1895,	June 17, 1896,	Oct.	23, 1896.
Dennis, .	.	.	.	.	.	Barnstable,	1896	Norton, C. H.,	.	Sept	24, 1896,	Oct. 26, 1896,	Dec.	10, 1896.
Easthampton,	.	.	.	.	.	Hampshire,	1895	Johnston, J. A.,	.	Aug.	15, 1895,	July 8, 1896,	July	16, 1896.
Easthampton,	.	.	.	.	.	Hampshire,	1895	Wheeler, R. C.,	.	Aug.	15, 1895,	July 17, 1896,	Sept.	1, 1896.
Easthampton,	.	.	.	.	.	Hampshire,	1896	Wheeler, R. C.,	.	July	23, 1896,	Sept. 1, 1896,	Oct.	3, 1896.
Fitchburg,	.	.	.	.	.	Worcester,	1895	Stuart, F. M., .	.	Sept.	26, 1895,	June 18, 1896,	Nov.	28, 1896.
Gloucester,	.	.	.	.	.	Essex, .	1895	Brown, C. L., .	.	Aug.	20, 1896,	Sept. 2, 1896,	Nov.	6, 1896.
Goshen, .	.	.	.	.	.	Hampshire,	1895	Nickerson, E., .	.	Aug.	15, 1895,	July 30, 1896,	Sept.	26, 1896.
Great Barrington,	.	.	.	.	.	Berkshire,	1896	Power, E. P., .	.	Sept.	24, 1896,	Oct. 12, 1896,	Dec.	29, 1896.
Hadley, .	.	.	.	.	.	Hampshire,	1894	Belknap, F. W.,	.	Sept.	25, 1894,	May 6, 1896,	May	16, 1896.
Hadley, .	.	.	.	.	.	Hampshire,	1895	Belknap, F. W.,	.	Aug.	8, 1895,	May 16, 1896,	May	26, 1896.
Hadley, .	.	.	.	.	.	Hampshire,	1896	Foster, F. H., .	.	Aug.	13, 1896,	Sept. 22, 1896,	Oct.	10, 1896.
Hadley, .	.	.	.	.	.	Hampshire,	1896	Hammersley, W. P.,	.	Aug.	13, 1896,	Oct. 10, 1896,	Nov	20, 1896.
Hancock,	.	.	.	.	.	Berkshire,	1895	Pillsbury, F. C.,	.	Sept.	5, 1895,	Jan. 1, 1896,	Jan.	25, 1896.
Hancock,	.	.	.	.	.	Berkshire,	1895	Pillsbury, F. C.,	.	Sept.	5, 1895,	June 22, 1896,	July	23, 1896.
Hancock,	.	.	.	.	.	Berkshire,	1895	Hight, C. M., .	.	Sept.	5, 1895,	July 24, 1896,	Oct.	1, 1896.
Hingham (1),	.	.	.	.	.	Plymouth,	1896	Williams, C. G.,	.	Aug.	27, 1896,	Sept. 24, 1896,	Nov.	28, 1896.
Hingham (2),	.	.	.	.	.	Plymouth,	1896	Williams, C. G.,	.	Oct.	22, 1896,	Oct. 26, 1896,	Nov.	28, 1896.
Holbrook,	.	.	.	.	.	Norfolk,	1896	Foster, F. H., .	.	Oct.	22, 1896,	Oct. 28, 1896,	Nov.	17, 1896.
Holbrook,	.	.	.	.	.	Norfolk,	1896	Belknap, F. W.,	.	Oct.	22, 1896,	Nov. 17, 1896,	Dec.	17, 1896.
Holden, .	.	.	.	.	.	Worcester,	1896	Warren, H. E.,	.	Sept.	24, 1896,	Oct. 9, 1896,	Dec.	9, 1896.
Huntington,	.	.	.	.	.	Hampshire,	1895	Power, E. P., .	.	July	18, 1895,	July 16, 1896,	Sept.	19, 1896.
Huntington,	.	.	.	.	.	Hampshire,	1895	Belknap, F. W.,	.	July	18, 1895,	Oct. 24, 1896,	Oct.	31, 1896.
Huntington,	.	.	.	.	.	Hampshire,	1896	Power, E. P., .	.	July	30, 1896,	Aug. 10, 1896,	Oct.	10, 1896.
Huntington,	.	.	.	.	.	Hampshire,	1896	Belknap, F. W.,	.	July	30, 1896,	Oct. 24, 1896,	Nov	13, 1896.
Lee, .	.	.	.	.	.	Berkshire,	1896	Grimes, M. W.,	.	Aug	27, 1896,	Sept. 11, 1896,	Nov.	10, 1896.
Leicester,	.	.	.	.	.	Worcester,	1895	Shaw, S., .	.	June	25, 1895,	May 18, 1896,	June	2, 1896.

TABLE SHOWING TOWNS AND CITIES IN WHICH WORK HAS BEEN DONE, ETC.— *Continued.*

TOWN OR CITY.	County.	Lay-out.	Resident Engineer.	Date of Contract.	Date of Beginning.	Date of Ending.
Leicester,	Worcester,	1896	Murray, J. D.,	July 16, 1896,	July 31, 1896,	Aug. 28, 1896.
Leicester,	Worcester,	1896	Johnston, J. A.,	July 16, 1896,	Sept. 21, 1896,	Dec. 12, 1896.
Lexington,	Middlesex,	1895	Wason, H. B.,	Aug. 2, 1895,	June 9, 1896,	Aug. 29, 1896.
Lexington,	Middlesex,	1896	Wason, H. B.,	July 6, 1896,	July 9, 1896,	Aug. 29, 1896.
Lincoln,	Middlesex,	1895	Bailey, W. K.,	Aug. 2, 1895,	Nov. 2, 1896,	Nov. 13, 1896.
Lincoln,	Middlesex,	1896	Bailey, W. K.,	July 9, 1896,	Aug. 11, 1896,	Nov. 17, 1896.
Marion,	Plymouth,	1895	Ruggles, E. F.,	Aug. 2, 1895,	June 17, 1896,	Oct. 10, 1896.
Marshfield,	Plymouth,	1896	Winslow, D. H.,	July 30, 1896,	Aug. 28, 1896,	Dec. 15, 1896.
Middleborough,	Plymouth,	1895	Shaw, S.,	June 27, 1895,	June 24, 1896,	Aug. 28, 1896.
Middleborough (1),	Plymouth,	1896	Shaw, S.,	July 23, 1896,	July 24, 1896,	Aug. 26, 1896.
Middleborough (2),	Plymouth,	1896	Shaw, S.,	Aug. 13, 1896,	Aug. 28, 1896,	Dec. 12, 1896.
Nantucket,	Nantucket,	1895	Murray, J. D.,	Nov. 23, 1895,	Jan 1, 1896,	Feb. 29, 1896.
Nantucket,	Nantucket,	1896	Murray, J. D.,	Nov. 5, 1896,	Oct. 14, 1896,	Dec. 31, 1896.
Newburyport,	Essex,	1896	Foster, E. S.,	Oct. 1, 1896,	Oct. 14, 1896,	Dec. 5, 1896.
Norfolk,	Norfolk,	1895	Grimes, M. W.,	Oct. 3, 1895,	April 24, 1896,	Aug. 13, 1896.
Norfolk,	Norfolk,	1895	Wason, H. B.,	Sept. 24, 1896,	Nov. 6, 1896,	Nov. 28, 1896.
North Adams,	Berkshire,	1896	Murray, J. D.,	Aug. 27, 1896,	Sept. 3, 1896,	Oct. 5, 1896.
North Adams,	Berkshire,	1896	Wheeler, R. C.,	Aug. 27, 1896,	Oct. 5, 1896,	Nov. 27, 1896.
North Attleborough,	Bristol,	1896	Warner, P. A.,	Sept. 1, 1896,	Sept. 17, 1896,	Nov. 5, 1896.
North Attleborough,	Bristol,	1896	Joyner, F. H.,	Sept. 1, 1896,	Nov. 5, 1896,	Dec. 1, 1896.
North Attleborough,	Bristol,	1896	Wheeler, R. C.,	Sept. 1, 1896,	Dec. 7, 1896,	Dec. 11, 1896.
North Attleborough,	Bristol,	1896	Keene, T. M.,	Sept. 1, 1896,	Sept. 14, 1896,	Sept. 16, 1896.
Norwood,	Norfolk,	1895	Manwell, F. P.,	Sept. 26, 1895,	Oct. 12, 1896,	Oct. 14, 1896.
Norwood,	Norfolk,	1896	Manwell, F. P.,	Aug. 6, 1896,	Aug. 21, 1896,	Oct. 15, 1896.
Orange,	Franklin,	1894	Brooks, S. H.,	June 25, 1895,	June 17, 1896,	Sept. 1, 1896.
Orange,	Franklin,	1894	Wheeler, W. B.,	June 25, 1895,	Sept. 2, 1896,	Sept. 9, 1896.

Orange, .	.	.	.	.	.	1894	Lyman, A. F.,.	.	June 25, 1896,	Sept. 10, 1896,	Nov. 17, 1896.
Orange, .	.	.	.	.	.	1894	Wheeler, W. B.,	.	June 25, 1895,	Nov. 18, 1896,	Nov. 28, 1896.
Orange, .	.	.	.	.	.	1895	Brooks, S. H.,.	.	July 18, 1895,	June 17, 1896,	Sept. 1, 1896.
Orange, .	.	.	.	.	.	1895	Wheeler, W. B.,	.	July 18, 1895,	Sept. 2, 1896,	Sept. 9, 1896.
Orange, .	.	.	.	.	.	1895	Lyman, A. F.,.	.	July 18, 1895,	Sept. 10, 1896,	Nov. 17, 1896.
Orange, .	.	.	.	.	.	1895	Wheeler, W. B.,	.	July 18, 1895,	Nov. 18, 1896,	Nov. 28, 1896.
Paxton, .	.	.	.	.	.	1895	Johnston, J. A.,	.	Aug. 1, 1895,	July 18, 1896,	July 25, 1896.
Paxton, .	.	.	.	.	.	1896	Johnston, J. A.,	.	July 6, 1896,	July 18, 1896,	Sept. 20, 1896.
Plymouth,	.	.	.	.	.	1895	Jones, L. H., .	.	June 25, 1895,	May 22, 1896,	June 4, 1896.
Plymouth,	.	.	.	.	.	1896	Nickerson, E.,	.	Oct. 22, 1896,	Nov. 24, 1896,	Dec. 31, 1896.
Rehoboth,	.	.	.	.	.	1895	Warren, H. E.,	.	Aug. 15, 1895,	July 17, 1896,	Oct. 6, 1896.
Rehoboth,	.	.	.	.	.	1896	Warren, H. E.,	.	July 9, 1896,	Sept. 22, 1896,	Oct. 6, 1896.
Russell, .	.	.	.	.	.	1894	Pillsbury, F. C.,	.	Oct. 4, 1894,	May 3, 1896,	June 11, 1896.
Russell, .	.	.	.	.	.	1895	Power, E. P., .	.	July 25, 1895,	Sept. 3, 1896,	Sept. 26, 1896.
Russell (1),	.	.	.	.	.	1896	Pierce, J. W.,.	.	July 16, 1896,	July 23, 1896,	Nov. 30, 1896.
Russell (2),	.	.	.	.	.	1896	Pierce, J. W.,.	.	Sept. 1, 1896,	Sept. 1, 1896,	Dec. 30, 1896.
Scituate, .	.	.	.	.	.	1894	Pillsbury, J. H.,	.	Sept. 24, 1896,	Oct. 22, 1896,	Dec. 11, 1896.
Scituate (1894-95),	.	.	.	.	.	1895	Pillsbury, J. H.,	.	Aug. 2, 1895,	Sept. 4, 1896,	Nov. 31, 1896.
Shelburne, .	.	.	.	.	.	1896	Wood, G. W.,.	.	July 9, 1896,	Aug. 17, 1896,	Dec. 5, 1896.
Shrewsbury, .	.	.	.	.	.	1895	Cutter, F. P., .	.	Aug. 8, 1895,	June 17, 1896,	Sept. 5, 1896.
Shrewsbury, .	.	.	.	.	.	1896	Cutter, F. P., .	.	Aug. 13, 1896,	Sept. 1, 1896,	Nov. 24, 1896.
Somerset, .	.	.	.	.	.	1895	Keene, T. M., .	.	Aug. 2, 1895,	July 20, 1896,	Aug. 29, 1896.
Somerset, .	.	.	.	.	.	1895	Harkness, G., .	.	Aug. 2, 1895,	Aug. 29, 1896,	Sept. 10, 1896.
Somerset, .	.	.	.	.	.	1895	Welton, C. A.,	.	Aug. 2, 1895,	Sept. 9, 1896,	Nov. 12, 1896.
Somerset, .	.	.	.	.	.	1896	Keene, T. M.,.	.	Aug. 27, 1896,	July 20, 1896,	Aug. 29, 1896.
Somerset, .	.	.	.	.	.	1896	Harkness, G., .	.	Aug. 27, 1896,	Aug. 29, 1896,	Sept. 10, 1896.
Somerset, .	.	.	.	.	.	1896	Welton, C. A.,	.	Aug. 27, 1896,	Sept. 9, 1896,	Nov. 12, 1896.
South Hadley,	.	.	.	.	.	1895	Ruggles, E. F.,	.	Aug. 27, 1896,	Oct. 12, 1896,	Dec. 3, 1896.
Taunton, .	.	.	.	.	.	1895	King, G. H., .	.	Aug. 22, 1895,	Oct. 22, 1896,	Nov. 20, 1896.
Taunton, .	.	.	.	.	.	1896	King, G. H., .	.	July 16, 1896,	Sept. 14, 1896,	Nov. 24, 1896.
Truro, .	.	.	.	.	.	1895	Joyner, F. H.,.	..	Oct. 8, 1896,	Dec. 2, 1896,	Dec. 31, 1896.

TABLE SHOWING TOWNS AND CITIES IN WHICH WORK HAS BEEN DONE, ETC. — *Concluded.*

TOWN OR CITY.	County.	Lay-out.	Resident Engineer.	Date of Contract.	Date of Beginning.	Date of Ending.
Tyngsborough,	Middlesex,	1895	Winslow, D. H.,	Aug. 15, 1895,	June 4, 1896,	Aug. 27, 1896.
Tyngsborough,	Middlesex,	1896	Peabody, W. W.,	Aug. 27, 1896,	Oct. 19, 1896,	Dec. 18, 1896.
Walpole,	Norfolk,	1895	Dadlar, A. D.,	Aug. 19, 1896,	Sept. 12, 1896,	Dec. 5, 1896.
Wareham,	Plymouth,	1896	"	July 6, 1896,	July 22, 1896,	Oct. 10, 1896.
Warren,	Worcester,	1895	"	Aug. 19, 1896,	Sept. 23, 1896,	Dec. 12, 1896.
Watertown,	Middlesex,	1895	W. P.,	Aug. 8, 1895,	June 15, 1896,	Sept. 19, 1896.
Watertown,	Middlesex,	1896	W. P.,	Aug. 20, 1896,	Sept. 21, 1896,	Oct. 9, 1896.
Westfield,	Hampden,	1896	Joyner, F. H.,	Sept. 1, 1896,	Sept. 8, 1896,	Nov. 4, 1896.
Westminster,	Worcester,	1895	Stuart, F. M.,	July 25, 1895,	July 30, 1896,	Dec. 4, 1896.
Westminster,	Worcester,	1896	Stuart, F. M.,	Aug. 20, 1896,	Aug. 25, 1896,	Dec. 4, 1896.
West Newbury,	Essex,	1895	Wheeler, W. B.,	Sept. 5, 1895,	May 11, 1896,	May 29, 1896.
West Newbury,	Essex,	1896	Keene, T. M.,	Aug. 27, 1896,	Sept. 18, 1896,	Dec. 18, 1896.
Westport,	Bristol,	1894	Keene, T. M.,	Nov. 1, 1894,	June 8, 1896,	July 18, 1896.
Westport,	Bristol,	1895	Maynard, G. F.,	Aug. 20, 1896,	Aug. 31, 1896,	Nov. 25, 1896.
West Springfield,	Hampden,	1895	Joyner, F. H.,	Oct. 1, 1895,	July 29, 1896,	Oct. 24, 1896.
West Springfield,	Hampden,	1896	Joyner, F. H.,	Sept. 24, 1896,	Sept. 14, 1896,	Oct. 24, 1896.
West Tisbury,	Dukes,	1895	Crowell, J. H.,	June 10, 1895,	Sept. 26, 1896,	Dec. 12, 1896.
West Tisbury,	Dukes,	1896	Crowell, J. H.,	July 30, 1896,	Sept. 26, 1896,	Dec. 15, 1896.
Weymouth,	Norfolk,	1895	Manwell, F. P.,	Aug. 15, 1895,	July 24, 1896,	Aug. 18, 1896.
Weymouth,	Norfolk,	1895	Winslow, G. R.,	Aug. 15, 1895,	Oct. 30, 1896,	Nov. 11, 1896.
Weymouth,	Norfolk,	1896	Winslow, G. R.,	Aug. 13, 1896,	Sept. 4, 1896,	Nov. 21, 1896.
Whitman,	Plymouth,	1895	Williams, C. G.,	Sept. 5, 1895,	July 15, 1896,	Aug. 25, 1896.
Whitman,	Plymouth,	1896	Williams, C. G.,	July 6, 1896,	July 13, 1896,	Sept. 15, 1896.
Wilbraham,	Hampden,	1895	Power, E. P.,	Sept. 24, 1895,	May 4, 1896,	July 11, 1896.
Wilbraham,	Hampden,	1896	Wason, H. B.,	Aug. 19, 1896,	Sept. 7, 1896,	Oct. 31, 1896.
Williamsburg,	Hampshire,	1896	Nickerson, E.,	Aug. 20, 1896,	Sept. 28, 1896,	Nov. 20, 1896.

Williamstown,	.	.	.	.	.	1895	Murray, J. D.,	.	Aug.	8, 1895,	Sept.	3, 1896,	Oct.	5, 1896.
Williamstown,	.	.	.	.	.	1895	Wheeler, R. C.,	.	Aug.	8, 1895,	Oct.	5, 1896,	Nov.	27, 1896.
Williamstown,	.	.	.	.	.	1896	Murray, J. D.,	.	Aug.	13, 1896,	Sept.	3, 1896,	Oct.	5, 1896.
Williamstown,	.	.	.	.	.	1896	Wheeler, R. C.,	.	Aug.	13, 1896,	Oct.	5, 1896,	Nov.	27, 1896.
Worcester,	.	.	.	.	.	1896	Macksey, H. V.,	.	July	16, 1896,	Sept.	17, 1896,	Nov.	13, 1896.
Worcester,	.	.	.	.	.	1896	Grimes, M. W.,	.	July	16, 1896,	Nov.	12, 1896,	Dec.	26, 1896
Yarmouth (North),	.	.	.	.	.	1894	Everett, P. H.,	.	Nov.	13, 1894,	April	17, 1896,	July	11, 1896.
Yarmouth (North),	.	.	.	.	.	1895	Everett, P. H.,	.	July	25, 1895,	April	17, 1896,	July	11, 1896.
Yarmouth (North),	.	.	.	.	.	1895	Howard, A. H.,	.	July	25, 1895,	July	20, 1896,	Oct.	13, 1896.
Yarmouth (North),	.	.	.	.	.	1896	Howard, A. H.,	.	July	6, 1896,	July	20, 1896,	Oct.	13, 1896.
Yarmouth (North),	.	.	.	.	.	1896	Litchfield, S.,	.	Sept.	10, 1896,	Oct.	9, 1896,	Dec.	17, 1896.
Yarmouth (South),	.	.	.	.	.	1895	Farrington, W. R.,	.	Aug.	22, 1896,	April	14, 1896,	July	3, 1896.
Yarmouth (South),	.	.	.	.	.	1895	Pillsbury, J. H.,	.	Aug.	22, 1895,	July	6, 1896,	Sept.	2, 1896.

APPENDIX F.

SHOWING THE INSTRUCTIONS GIVEN TO ASSISTANT, DIVISION AND RESIDENT ENGINEERS, TO GUIDE THEM IN THEIR WORK.

INSTRUCTIONS TO ASSISTANT ENGINEERS.

1. You will be assigned the work you are to perform by the Principal Assistant Engineer, and you will be subject to his instructions.
2. You will be held responsible for the accuracy of all work under your charge, and also for the conduct of your assistants when they are away from the office of the Commission.
3. Employees of this department must not enter the rooms of the executive department during office hours, unless by the direction of the Principal Assistant Engineer.

INSTRUMENTS.

4. All instruments and tools which you may take from the office must be returned in as good order as when they are taken away, reasonable wear excepted; you will notify the Principal Assistant Engineer of any defect in instruments before they leave the office, otherwise the expenses of repairing the same will be charged to your account. All instruments must be carried to and from the work, and in no case are you to send them by express or check them as baggage. You will not be allowed storage on instruments.
5. Any damage due to carelessness to an instrument is to be paid by the employee having charge of it, but the assistant in charge will be held responsible for and must report any accident, together with the name of the person accountable for it, to the Principal Assistant Engineer.

TRANSPORTATION.

6. You will be allowed transportation as follows:—
From the office to your work and return, and from one work to another.
From your hotel or boarding-house and return *once* each day *only* when the nearest part of the work is one mile or more distant

from such place of residence. This will be allowed only when it is impossible to secure a boarding place nearer the work.

No carriage hire will be allowed when a public conveyance is available.

SUBSISTENCE.

7. You are allowed subsistence under the following-described circumstances : —

From the time you leave Boston until you return, but only when your work requires you to remain away from Boston over night.

You will not be allowed subsistence when the cost of transportation from Boston and return is less than the cost of subsistence, provided, however, you can reach your work at or before 9 A.M., and will not be obliged to leave it before 5 P.M.

EXPENDITURES AND BILLS.

8. On reaching the work you must secure a boarding place as near the location as possible. Due economy must be observed in contracting bills for subsistence. All unnecessary telephone and telegraph messages must be paid for by you.

9. All bills for services for yourself and your assistants must be submitted hereafter on bill heads to be furnished you on leaving the office. They are to be filled out neatly in ink, and are to show the city or town in which work has been done, the nature of the work (whether surveying, setting stakes, cross-sectioning, resetting stakes, etc.), the number of days on each part of the work, and are to be otherwise filled out in full.

The bills are to be filled out in two classes, viz., those charged against the appropriation for "engineering" and those charged against the appropriation for "construction."

"Engineering" will include original surveys, levellers for profiles and cross-sections, and the first location.

"Construction" will include staking out for lines and grade, resetting stakes, and final cross-sections.

10. You are to agree as to price of stakes and their delivery at the time of ordering, and you must proceed with the work while awaiting such delivery.

11. You must have all bills for subsistence and materials furnished made out to Massachusetts Highway Commission before leaving your boarding place or hotel, and must at once approve and send them to the office.

12. Vouchers must, when possible, be obtained for all money paid, and an account must be kept of all the money and mileage used, the amounts chargeable to each piece of work to be kept together. If an advance is made by the office for your incidental

expenses you will make a return in bill form as soon as the money is expended, accompanied by the vouchers, showing for what purpose and in what city or town the money was expended. Where money is used for car fare or carriage hire you are to show between what points such expenditures have been made. You will provide for the above-noted allowable expenses of your party, and your returns will include the names of your assistants.

13. Any bills having erasures will be returned to you, as no bill will be approved by the Commission which has any erasures on it. Bills for subsistence are to show the names of all persons in the party.

14. If any neglect of the points specified above occurs your bills will be returned to you, and such omissions will probably delay the payment for a month.

USE OF MILEAGE BOOKS.

15. No mileage book furnished by the Commission is to be used for private purposes.

No mileage book is to be used for any other purpose than that designated on the book. Mileage books are classified under "engineering" and "construction."

"Engineering" will include original surveys, levels for profiles and cross-sections, and the first location.

"Construction" will include staking out for lines and grade, resetting stakes, and final cross-sections.

FIELD NOTES.

16. The field notes are to be kept according to the standard system of the office, and must be complete in themselves.

17. On the completion of the work in any place the note-book must at once be returned to the office, addressed to the Principal Assistant Engineer. The note-books are not for the use of the Resident Engineers; any notes they may need you will furnish to them.

18. Separate books must be used for surveys on each road.

REQUIREMENTS IN SURVEYS.

19. (a) Surveys are to be made on a transit line, checked by repeating each angle and by taking compass readings.

The base line is to follow the approximate centre of the road.

Where defined by walls or fences you are to obtain the centre by measuring between them; where there are no visible boundary lines of the location you must, as far as possible, use the centre of the travelled way.

Where there is an existing "lay-out" you must, if possible, determine and use the centre as your base line.

You are carefully to locate all walls, fences, ditches, etc., which indicate boundaries of the road or of abutting property; also all houses within one hundred (100) feet of the line of location; also all cross streets for a distance of two hundred (200) feet from the line of location.

At each fifty (50) feet on the base line, and at each cross street or driveway, elevations are to be taken at the station, at each side of the location, and at such other points as may be needed to plot a true and accurate profile of the road. Elevations must also be taken of the ground at the front corners of buildings, and of the bottoms of sills of buildings where the same are within fifty (50) feet of the location.

(b) All existing culverts and drains are to be located; the size and condition noted; elevations taken at both ends and also elevations to show the bed of the stream for fifty (50) feet each side of the location. Where, in your opinion, new culverts may be needed you will indicate their proposed location and size.

(c) Locate all bridges; give the dimensions of the openings; the nature of construction; measurements and conditions of the abutments and structure; height of stream at time of freshets; direction of flow of stream and elevations on bed of stream at each end of the bridge for a distance of fifty (50) feet from each side. Give the approximate area of the watershed and note whether there are indications that the water ever overflows the road.

(d) Locate gutters, curbing, catch-basins, and trees of value as shade trees.

(e) The following information is also to be given, fully and concisely:—

Quality and nature of the materials at each station.

The most advantageous location for a crushing plant.

Available places for water supply for roller and watering cart.

Distance in feet to the nearest side track where stone might be delivered by rail, giving name of railroad.

Location of gravel pit or pits, with samples of the gravel, which are to be properly marked and sent to the office.

Where stone for culverts and for cobble-stone gutters may be obtained.

Description of field stone in vicinity of the road.

Location of telegraph, telephone and other poles.

Price of laborers, and of single and double teams.

Cost of fencing material, rails, posts, etc.

Where guard rails, telford, cobble-stone gutters, side drains,

etc., are needed note these facts, with statement of quantities sufficiently accurate for an estimate.

The statements as above required are to be put in the note-book on the pages immediately following the survey notes.

INSTRUCTIONS TO DIVISION ENGINEERS.

1. You will be assigned the work you are to perform by the Chief Engineer, and be subject to his instructions.

2. On being assigned to a division your permanent residence will be chosen, as far as may be, so as to enable you to reach all parts of your work in the most economical and convenient manner.

You will be allowed your necessary travelling expenses from the office to your permanent residence and return *once*, and in addition to this as often as you may be required to report to the office.

You will be allowed your transportation from your permanent residence to and return from each piece of work in your division as often as may be necessary to exercise a proper supervision.

You will pay your own subsistence while at your permanent residence.

You will be allowed subsistence when you report to the office, and also when away from your permanent residence on tours of inspection.

You will return to your permanent residence each night except when the cost of transportation will exceed the cost of lodging and subsistence.

No carriage hire will be allowed when a public conveyance is available.

3. It will be your duty to see that each Resident Engineer in your division shall properly inspect the work done on the contract under his charge, and you will be held responsible for all such work.

4. When the Resident Engineer on any work in your division notifies you that he is ready to begin work, you will, as soon as possible, meet him on the work, and in company with him examine the grade stakes, compare the marks on them with the profile, and report in writing to the Chief Engineer any discrepancy.

You will also advise with the Resident Engineer on the selection of material which the contractor proposes to furnish.

You will remain on the work until you are satisfied that the Resident Engineer fully understands how he is to proceed with the construction of the road.

5. When the road-bed of any road in your division is graded and shaped ready to receive broken stone or telfording, you will be on hand ready to advise with the Resident Engineer as to the proper manner of proceeding in order to obtain the best results.

6. You will inspect each and every road in your division at least once each week, and oftener if possible, and report daily to the Chief Engineer, in writing, the condition of the roads inspected and whether the work is progressing satisfactorily. Your report will note any interruption in the work, together with the cause of such interruption. You will inspect the different books of the Resident Engineer and see that they are kept in a proper manner.

7. You are not in any manner to interfere in municipal affairs, or express opinions concerning such matters. You are to see that the work is done according to the contract and specifications, supplemented by the orders of the Chief Engineer. The hours of work and the wages paid by the contractors are matters for their determination. Use tact and discretion in your intercourse with municipal officials, and remember that your services are paid for by the Commission to secure the best work, and otherwise to guard the interests of the Commonwealth. Do not overstep your authority. Give all necessary information freely to those in charge of the work for the contractor. Criticisms of the contractor, the Board or its servants must not be made. You must not give any information as to the actual cost of the work; such information can come only through the office. You are at liberty to explain the methods employed by the State.

8. You must make out and approve all bills for transportation and subsistence to the Massachusetts Highway Commission, together with your salary bill, and send to the office on or before the twentieth day of each month.

9. Vouchers must, when possible, be obtained for all money paid, and an account must be kept of all money and mileage used, the amount chargeable to each piece of work to be kept together. You will pay your incidental expenses and make a return in bill form, weekly, of the money so expended, accompanied by the vouchers, showing for what purpose and in what city or town the money was expended. Where money has been used for car fare or carriage hire you are to show between what points such expenditures have been made.

10. No bill will be approved by the Commission which has any erasures on it. Any bill having erasures will be returned to you.

11. No mileage book furnished by the Commission is to be used for private purposes.

12. When in your opinion any work not included in the con-

tract is necessary, you must notify the Chief Engineer, in writing, of the fact, setting forth the manner and limits of such work, and await his written order.

13. You are required to pay for any unnecessary telephone or telegraphic charges.

14. If any neglect of the above-specified points occurs, your bills will be returned to you, and such omissions will probably delay the payment for a month.

15. On leaving the office you will see that you are provided with the following supplies, to be used by you, the same to be returned in good order when the work is completed : —

- (a) 1 steel tape, 100 feet long.
- (b) 1 cloth tape, 50 feet long.
- (c) 1 steel scale (40–80).
- (d) 1 sketch book.
- (e) Copy of Instructions to Resident Engineers.
- (f) Reports, paper and envelopes.

INSTRUCTIONS TO RESIDENT ENGINEERS.

1. On receiving notice that you have been appointed to serve as Resident Engineer you will at once report to the general office, 15 Court Square, Boston. On receiving instructions from the Chief Engineer you will immediately proceed to your station by the most direct route, and there remain until recalled or ordered elsewhere. Your transportation will be allowed once each way from the office to your station. If ordered to the office or any other place during the progress of the work the necessary transportation will also be allowed. No carriage hire will be allowed where there is any available public conveyance. All communications in regard to the work are to be addressed to the Chief Engineer.

When required by the following rules to send a written communication to the contractor you must retain a copy thereof and also immediately send a copy to the Chief Engineer, referring to the section of the rules under which you are acting.

2. On reaching your station you must secure a boarding-place as near to the work as possible. You will bear the cost of your own board and furnish your own transportation from your boarding place to and from the work.

You will at once report the location of your boarding-place, the

name of the person with whom you board, your exact post-office address and the name of the freight station nearest the work.

3. You must then make a careful study of the lay-out and grades, and be sure that you thoroughly understand the marks on the stakes with reference to both lines and grades. Any apparent discrepancy between the lines or grades as indicated on the plans or profiles and the marks on the stakes must be immediately reported in writing.

4. You will then notify the contractor, in writing, that you are ready to begin the work.

5. You will also confer with the contractor with reference to when and where the work is to be begun; you will examine the location and quality of the different materials which he proposes to furnish, reporting the result of your examination, and await the decision of the Chief Engineer before accepting or rejecting any material.

6. You are not to interfere with the management of the men employed on the work; if they do not perform their duties in a satisfactory manner you will at once notify the superintendent in charge.

7. As Resident Engineer you are not the superintendent for the town, city or contractor.

The contractor, whether an individual or a municipality, must furnish a competent superintendent to take charge of the work; if this is not done you will at once report to the Chief Engineer.

You are expected to make yourself as useful as possible in furthering the work, but it is to be distinctly understood by the Commission and contractor that any advice you may give as to the management of the men and teams, or as to the purchase of material, shall not in any way be held as an act of the Commission.

8. You are to give the contractor the lines and grades required in the work. The red line on the profile is the accepted grade of the centre of the finished road, and should correspond with the marks on the stakes.

9. If the grade stakes are displaced at any time you will, unless you can properly replace them, at once notify the office.

If the stakes are broken off or displaced through carelessness on the part of employees of the contractor, he must at once be notified in writing that they are to be replaced at his expense.

10. You will see that the requirements of the contract and specifications are in each instance carried out in every detail. On the discovery of any violations of either the contract or specifications a written notice must be served on the superintendent for the contractor, and a copy thereof sent to this office without delay. If

matters come up that you think should be considered, call the attention of the Chief Engineer to them the next time he visits the work, or write him fully concerning them, and be guided by the instructions received. Notify the Chief Engineer and the contractor, in writing, when the work is not being done to the best advantage by the contractor.

11. No order which varies from the regular printed specifications shall be accepted by you unless the order is in writing and signed by the Chief Engineer. *You are to send a copy of such order to the office at once.*

12. When in your opinion any work not included in the contract is necessary, you must notify the Chief Engineer, in writing, of the fact, setting forth the manner and limits of such work, and await his written order. If the Chief Engineer reports favorably on your suggestion, you will immediately serve a copy of his letter on the contractor. You must at once report the date and time of receiving such notice.

13. At no time during the progress of the work are you to leave it, except in cases of absolute necessity, without written permission from the Chief Engineer. All reports are to be made up at such times as the work is not in progress on account of storms or other interruptions.

14. You are to secure all necessary data, while on the work, for the plotting of the office plan and profile on your return; also all data concerning culverts, catch-basins, side drains, telford, guard rail or other fencing, the location of macadam, telford, cobble gutters and all other features which should properly be shown on such plan and profile to give a complete record of all work done.

15. Do not in any manner interfere in municipal affairs or express opinions concerning such matters. You are to see that the work is done according to the contract and specifications, supplemented by your instructions and the orders of the Chief Engineer. The hours of work and wages paid by the contractors are matters for their determination. Use tact and discretion in your intercourse with municipal officials, and remember that your services are paid for by the Commission to secure the best work and otherwise to guard the interests of the Commonwealth. Do not overstep your authority. Give all necessary information freely to those in charge of the work for the contractor. Criticisms of the contractor, the Board or of its servants must not be made.

You must not give any information as to the actual cost of the work; such information can only come through the office. You are at liberty to explain the methods employed by the State.

16. Blank orders on the State Treasurer for wages due will be sent with monthly estimate sheets ; these orders are not to be sent to the office of the State Treasurer until the first day of each month.

17. Your salary account must be sent to this office so as to be received before the twentieth day of each month. All bills containing erasures will be returned to you.

18. No mileage book furnished by the Commission is to be used for private purposes.

19. You will be required to pay any unnecessary telegraph or telephone charges.

20. You are to keep an accurate account of all the work done on the road ; also to ascertain the exact cost of doing it, whether performed by the contractor directly or by a sub-contractor ; this is necessary in order to afford a basis for future contracts. It is for the purpose of collecting and entering this information in convenient form that the daily record book is supplied. In order to get this information and to see that the work is properly conducted, you must remain on the road whenever work is in progress. All the blanks marked with a star in your daily report book should have the proper entry made in ink, and great care should be taken to have each item as accurately stated as possible, without repetition of the same matter under different heads. *All the blanks on the first printed page headed "prices paid by town — contractor for labor" are to be filled in.* If anything appears during the work which is not provided for in the record book, you are to use the blank spaces. *A complete record of all work must be kept.*

DAILY REPORTS.

21. Daily report cards will be supplied, and one must be sent to this office daily, properly filled out, whether work is done on your section or not.

WEEKLY REPORTS.

22. On the weekly report forms, which will be supplied, you will fill with black india ink between the parallel lines opposite the various items of construction, and under the stations as shown at top of sheet, the length completed at the end of the week. You will also fill out the column concerning quantities as near as possible ; also all time relating to extra work.

Under "remarks" you will state facts concerning the progress of the work, such as delays caused by the weather, want of laborers, lack of stone, breaking of machinery, etc.

The spaces between the parallel lines are to be completely filled

in when the work is completed between the stations indicated. When the work is only partly done, show between what stations work has been commenced by partially filling in the spaces above mentioned.

MONTHLY ESTIMATES.

23. Each month an estimate sheet will be sent you for your return of the quantities moved during the month. A sufficient number of sheets will be sent to enable you to make the estimate in triplicate, all of which will be sent to the office. The "quantities previously estimated" column will show the quantities paid for. The figures in this column will be entered at the office, and are not to be changed by you. If they appear to you to be incorrect, write to the office for particulars. The "quantities of this estimate" column is to show the quantities to be paid for on the bill prepared by you for the month's work. The "total quantities estimated to date" column will of course show the total of the other two columns. Each sheet is to have your signature attached to it and is to be otherwise fully filled out. A copy of the bill as approved by the Board will be sent you each month, and a similar copy will be sent to the contractor.

24. On leaving the office for the work you will see that you are supplied with the following articles, to be used by you; these are, with the exception of expended stationery, to be returned to the office in good order when the work is completed, viz.: —

- (a) 1 steel tape, 100 feet long.
- (b) 1 cloth tape, 50 feet long.
- (c) 2 plumb bobs.
- (d) 1 steel scale (40–80).
- (e) 1 daily record book (red cover).
- (f) 1 sketch book (black cover).
- (g) 1 calculation book.
- (h) 1 copy of contract and specifications.
- (i) A lot of weekly reports, paper and envelopes.
- (j) Certificates for stone delivered on road.
- (k) Plans and profile, and cross-sections of road.
- (l) A "quantity sheet," showing amount of material to be moved.

25. All books supplied to Resident Engineer must at all times be open to the inspection of the Chief Engineer or his authorized assistants. Resident Engineers will be held responsible for all articles supplied to them from this office, and will be required to give a receipt for them.

DETAILS OF THE WORK.

Excavation.

26. In all excavation, as the work progresses, you will have the slopes and surfaces completed so that the quantities can be taken from the cross-sections. In embankment, if there is a surplus of material, widen uniformly on each side and make the slope two (2) to one (1) or less. If there is a deficiency of material after making all excavations, the material for embankments is to be obtained by widening excavations, where the width of roadway will permit; otherwise from borrow pits, previously cross-sectioned, as directed by the Chief Engineer or some person duly authorized by him. The borrow pits are to be paid for by the contractor. The material taken from them must be satisfactory to the Engineer. If separate prices are made in the contract for sand, gravel, hard-pan or clay excavation, you are to ascertain accurately and record the quantity of each.

27. Material taken from borrow pits and used in embankment is to be allowed for once only at the excavation price.

28. For excavation required in the case of culverts, retaining walls or telford separate entries of the quantities must be made, as such excavation is not included in the statement of quantities furnished you on leaving the office. This excavation is to be paid for at the regular contract price.

29. Excavation for cobble gutters, pipe culverts or side drains is not to be allowed, as the cost is included in the price allowed for that class of work. Great care should be taken that such quantities are not included in earth excavation. In case ledge is met with, the regular price for ledge excavation is to be allowed.

30. Notes of all excavations not included in the cross-sections must be kept in the sketch book, and data for plotting these sections must be sent to the office. All calculations must be made in the book provided for that purpose, and the computations kept in a systematic manner.

31. All extra excavation caused by error of Resident or Locating Engineer must be allowed to the contractor, and report of it sent to the Chief Engineer immediately on the discovery of such error. Any failure to report an error of this kind will be considered sufficient cause for immediate discharge.

32. All trees, excepting those to be reserved for shade, and all stumps and brush lying between the tops of new slopes of excavation and bottom of slopes in embankments must be removed by the contractor when ordered so to do by the Engineer, and the

work is not to be considered as an extra, being included in the contract price for excavation.

33. The contractors are required to smooth off slopes of both excavation and embankment, and to remove all rubbish. Payments for finishing between limits are to include only work between the foot of slopes or top of cuts and the line of location.

Culverts.

34. In culverts you will have suitable stone used; the foundations to be two and one-half ($2\frac{1}{2}$) feet or more below the natural surface, breaking joints one (1) foot; no spalls are to be allowed on the face. The ends of culverts shall be laid parallel to the centre line of broken stone. The end, or face, walls shall be of coursed rubble, breaking joints at least one (1) foot, and have no "pinners" on the face, joints not to exceed one (1) inch. The wall shall be capped with covering stones one (1) foot in thickness, at least two (2) feet in width and long enough to rest on the wall at least one (1) foot on each side. The culverts are to be sufficiently long to extend at least to the end of the slopes. In rebuilding culverts the ends are to be without spalls. The other parts of the work which are not exposed are to be of any split quarry stone, or that split from boulders and laid true to line. All face masonry, or culvert ends, are to be paid for at the price allowed for rubble masonry laid in cement, as stated in contract. Face masonry is to be measured two (2) feet back from the face. All necessary excavation met with in the construction of stone culverts is to be regarded as a "pay" quantity, and the cost and amount must be recorded in such a manner as to be readily figured separately from the cost and quantity of rubble masonry. All masonry is to be measured in accordance with the sections.

Gravel.

35. You will use gravel for surfacing the roadbed under telford; also for surfacing the sub-grade where the natural soil is clayey, loamy, or where ordered under other conditions by the Chief Engineer. The gravel must be practically free from sand and clay. It is not to be used for making embankment unless the contractor will furnish it at the regular excavation prices. Gravel pits must be cross-sectioned and quantities estimated in the bank. All gravel found within the limits of location is to be paid for as excavation only. Gravel used in the construction of drains, or broken stone used for the same purpose, is not to be considered a "pay" quantity; the cost of all incidentals in such work is included in the price paid for it. Unless suitable gravel can be pro-

vided, the shoulders will be built of the best selected material from the excavation, unless other otherwise ordered by the Chief Engineer.

Shaping.

36. By shaping is meant the preparation of the roadbed for the broken stone. It is paid for by the square yard, and in measuring, the full width covered by the broken stone and shoulders is to be reckoned.

Broken Stone.

37. State highways are divided as follows with reference to the broken stone (sizes given are in inches) : —

a. All trap rock. Bottom course to be $1\frac{1}{4}$ to $2\frac{1}{2}$; top course to be $\frac{1}{2}$ to $1\frac{1}{4}$.

b. All trap rock. Both courses to be $1\frac{1}{4}$ to $2\frac{1}{2}$.

c. Local stone other than trap. Bottom course to be $1\frac{1}{4}$ to $2\frac{1}{2}$; top course to be $\frac{1}{2}$ to $1\frac{1}{4}$.

d. Local stone other than trap. Both courses to be $\frac{1}{2}$ to $2\frac{1}{2}$.

e. Bottom course of local stone other than trap $\frac{1}{2}$ to $2\frac{1}{2}$; top course of trap rock $\frac{1}{2}$ to $1\frac{1}{4}$.

f. Bottom course of local stone other than trap $\frac{1}{2}$ to $2\frac{1}{2}$; top course of trap rock $1\frac{1}{4}$ to $2\frac{1}{2}$.

g. All trap rock. Bottom course to be $\frac{1}{2}$ to $1\frac{1}{4}$; top course to be $1\frac{1}{4}$ to $2\frac{1}{2}$.

h. Local stone other than trap. Bottom course to be $\frac{1}{2}$ to $2\frac{1}{2}$; top course to be $1\frac{1}{4}$ to $2\frac{1}{2}$.

38. Before leaving to take charge of any particular work you will be instructed by the Chief Engineer in which of the above-mentioned divisions your road belongs.

39. The above-noted list does not include the screenings, or binder, course; this will be described in the contract and specifications.

40. You must carefully examine all stone which the contractor furnishes, and insist upon its conforming, both in quality and sizes, with the requirements of the classification above described.

41. When "local stone other than trap" is used you must not allow any soft or disintegrated rock to go upon the road; all such rock must be rejected before breaking. If the contractor fails to remove such rock, immediately report the fact in writing to the Chief Engineer.

42. All broken stone must be screened, and any broken stone which will not pass through a two and one-half ($2\frac{1}{2}$) inch ring, or is more than two and one-half ($2\frac{1}{2}$) inches in its largest diameter, must be rebroken or rejected.

43. In every case the screenings used on the surface as a binder course must be of the same kind of stone as the top course of the road.

44. Great care must be taken at any stage of the work to prevent any waste of broken stone. You must keep careful watch at the crusher, at the cars, on the shoulders or at any dump to prevent such waste. You must see that the scales are adjusted each day.

45. All broken stone used in any drain or gutter, or on any part of the road except the hardened way, must be deducted from the estimate of broken stone used in building, and a report made of the quantity so used.

46. *Class a.* — All trap rock. Bottom course $1\frac{1}{4}$ to $2\frac{1}{2}$; top course $\frac{1}{2}$ to $1\frac{1}{4}$.

Where the traffic is not very heavy and trap rock is used it must be spread in two courses, viz., the bottom course of sizes varying from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches; the top course in sizes varying from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be four (4) inches thick at the centre and three (3) inches thick at the sides, after rolling. The top course is to be two (2) inches thick after rolling.

Where telford is used, the bottom course is to be two and one-half ($2\frac{1}{2}$) inches thick after rolling; the top course one and one-half ($1\frac{1}{2}$) inches thick after rolling.

The binder course in all cases must only be sufficient to cover the coarser stone after it has been rolled.

Each course of broken stone must be rolled separately and evened up with stone of the same sizes as have been used in that particular course.

47. *Class b.* — All trap rock. Both courses $1\frac{1}{4}$ to $2\frac{1}{2}$.

Where the traffic is heavy and trap rock is purchased by the contractor and imported, it must be spread in two courses where there is no telfording and in one course where a telford foundation is used, and in sizes varying from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches in diameter.

Where the foundation is good and no telfording is used the bottom course is to be three and one-half ($3\frac{1}{2}$) inches thick in the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling. The top course is to be two and one-half ($2\frac{1}{2}$) inches thick after rolling.

Where telfording is used, the broken stone is to be four (4) inches thick after rolling.

The binder course in all cases is to be sufficient only to cover the coarser stone after it has been rolled.

Where there is no telfording, each course of broken stone is to be rolled separately and evened up.

Where telfording is used, the two courses of stone are to be rolled as one course and evened up.

48. *Class c.* — Local stone other than trap. Bottom course $1\frac{1}{4}$ to $2\frac{1}{2}$; top course $\frac{1}{2}$ to $1\frac{1}{4}$.

Where the travel is comparatively light and the broken stone is of fairly good quality, it must be spread in two courses, viz., the bottom course of sizes varying from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches; the top course in sizes varying from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be four (4) inches thick at the centre and three (3) inches thick at the sides, after rolling; the top course two (2) inches thick after rolling.

Where telfording is used, the bottom course is to be two and one-half ($2\frac{1}{2}$) inches thick after rolling; the top course one and one-half ($1\frac{1}{2}$) inches thick after rolling.

The binder course is to be sufficient only to cover the coarser stone after it has been rolled.

Each course of broken stone is to be separately rolled and evened up with stone of the same sizes as have been used on that particular course.

49. *Class d.* — Local stone other than trap. Both courses $\frac{1}{2}$ to $2\frac{1}{2}$.

Where the travel is not very heavy and the local broken stone is of fairly good quality, it must be spread in two courses where there is no telfording and in one course where telfording foundation is used, and in sizes varying from one-half ($\frac{1}{2}$) to two and one-half ($2\frac{1}{2}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be three and one-half ($3\frac{1}{2}$) inches thick in the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling. The top course is to be two and one-half ($2\frac{1}{2}$) inches thick after rolling.

Where telfording is used, the broken stone is to be four (4) inches thick after rolling.

The binder course in all cases must be sufficient only to cover the coarser stone after it has been rolled.

Each course of broken stone is to be rolled separately and evened up with stone of the same sizes as have been used in that particular course.

The screen must be arranged without any one and one-quarter ($1\frac{1}{4}$) inch opening ; all the stone from one-half ($\frac{1}{2}$) to two and one-half ($2\frac{1}{2}$) inches must pass directly to one bin, and be thoroughly mixed. You must not allow the broken stone which is not thoroughly mixed to be used.

50. *Class e.* — Bottom course local stone other than trap $\frac{1}{2}$ to $2\frac{1}{2}$; top course trap rock $\frac{1}{2}$ to $1\frac{1}{4}$.

Where the travel is not very heavy, the supply of broken stone cheap but of poor quality, and trap rock can be imported at a reasonable cost, the broken stone must be spread in two courses, viz., the bottom course of local stone varying in size from one-half ($\frac{1}{2}$) to two and one-half ($2\frac{1}{2}$) inches ; the top course of trap rock in sizes varying from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be of local stone three (3) inches thick in the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling. The top course is to be of trap rock three (3) inches thick at the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling.

Where telfording is used, local broken stone is to be spread and rolled to bring the crown up to within three (3) inches of the finished grade and cross-section. Trap rock varying in size from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches must then be spread, to give a thickness of three (3) inches after rolling.

The binder course in all cases must be sufficient only to cover the coarser stone after it has been rolled.

Each course of broken stone must be rolled separately and evened up with stone of the same sizes as have been used in that particular course.

51. *Class f.* — Bottom course local stone other than trap $\frac{1}{2}$ to $2\frac{1}{2}$; top course trap rock $1\frac{1}{4}$ to $2\frac{1}{2}$.

Where the travel is heavy, the supply of local stone cheap but of poor quality, and trap rock can be imported at a reasonable cost, the broken stone must be spread in two courses, viz., the bottom course of local stone varying in size from one-half ($\frac{1}{2}$) to two and one-half ($2\frac{1}{2}$) inches ; the top course of trap rock varying in size from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be of local stone three (3) inches thick at the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling. The top course is to be of trap rock three (3) inches thick at the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling.

Where telfording is used, local broken stone is to be spread and rolled to bring the crown up to within three (3) inches of the finished grade and cross-section. Trap rock varying in size from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches is then to be spread to give a thickness of three (3) inches after rolling.

The binder courses in all cases must be sufficient only to cover the coarser stone after it has been rolled.

Each course of broken stone must be separately rolled and evened up with stone of the same sizes as have been used in that particular course.

52. *Class g.* — All trap rock. Bottom course $\frac{1}{2}$ to $1\frac{1}{4}$; top course $1\frac{1}{4}$ to $2\frac{1}{2}$.

Where the travel is heavy, and the trap rock is broken by the contractor, or is purchased at a local crusher, it must be spread in two courses, viz., the bottom course of sizes varying from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches; the top course varying in size from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be two and one-half ($2\frac{1}{2}$) inches thick, after rolling.

The top course is to be three and one-half ($3\frac{1}{2}$) inches thick at the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling.

In case there is a surplus or deficiency of the one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inch sizes, you will increase or diminish the thickness of the bottom course so as to use all of the product of the crusher, and correspondingly increase or diminish the thickness of the top course.

Where telfording is used, broken stone varying from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches is to be spread and rolled to bring the crown up to within three (3) inches of the finished grade and cross-section.

The binder course in all cases must be sufficient only to cover the coarser stone after it has been rolled.

Where there is no telfording, each course of broken stone is to be separately rolled and evened up with stone of the same sizes as have been used in that particular course.

Where telfording is used, the two courses of broken stone are to be rolled as one course, and the top course is to be evened up with stone varying from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches.

53. *Class h.* — Local stone other than trap. Bottom course $\frac{1}{2}$ to $2\frac{1}{2}$; top course $1\frac{1}{4}$ to $2\frac{1}{2}$.

Where the travel is heavy, and the local broken stone is not of the best quality, and the cost of importing stone would be too great to allow of its use, the broken stone must be spread in two courses, viz., the bottom course of sizes varying from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches; the top course varying in size from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches.

Where the foundation is good and no telfording is required, the bottom course is to be two and one-half ($2\frac{1}{2}$) inches thick after rolling. The top course will be three and one-half ($3\frac{1}{2}$) inches in thickness at the centre and two and one-half ($2\frac{1}{2}$) inches thick at the sides, after rolling.

In case you find you will have a surplus of the one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inch sizes, you will immediately increase the thickness of the bottom course so as to use all the product of the crusher, and correspondingly decrease the thickness of the top course.

Where telfording is used, the broken stone varying in sizes from one-half ($\frac{1}{2}$) to one and one-quarter ($1\frac{1}{4}$) inches is to be spread to a depth not exceeding two (2) inches, and this covered with the broken stone varying in size from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches, to give a thickness of four (4) inches of broken stone after rolling.

The binder course in all cases must be sufficient only to cover the coarser stone after it is rolled.

Where there is no telfording, each course of broken stone must be separately rolled and evened up with stone of the same sizes as have been used in that particular course.

Where telfording is used, the two courses of broken stone are to be rolled as one course, and the top course will be evened up with stone varying in size from one and one-quarter ($1\frac{1}{4}$) to two and one-half ($2\frac{1}{2}$) inches.

Rolling.

54. When possible roll the sub-grade with a steam roller.

55. If the sub-grade is too sandy to roll, cover with coarse gravel laid on to a depth of three (3) inches, or as much more as may be needed to give a good foundation.

56. Fill any depressions with the same material until the surface is true and even.

57. All broken stone must be rolled in screened layers.

58. After spreading the first course of broken stone, begin rolling at the sides, and continue this by running ahead so as to allow from two (2) to five (5) inches of the driving wheel to pass over the shoulder, and backward with the outer edge of the driving

wheel from five (5) to ten (10) inches inside the edge of the broken stone. Roll until the stone ceases to "wave" in front of the wheels, and until it seems firm under foot as you walk over it. Next begin on the other side and roll in the same manner. Then work toward the centre until the stone is rolled. Roll each layer of stone in the same manner.

59. If the road shows a wavy motion after passing the roller over it three, four or more times, it may indicate too much moisture in the sub-grade. If, on examination, you find this to be true, stop rolling and move ahead, allowing time for the sub-grade to dry out.

60. With some coarse, hard granitic rocks it has been noted that after the roller passes over them a few times they begin to "crawl" and the sharp edges break off. A slight sprinkling of sand or stone screenings, or water, may prevent this. Try one after another of these means, until the work progresses to your satisfaction. You must not expect to prevent the stone from shaking as you walk over it, but you need to continue the rolling until the fragments of stone adjacent to where the foot presses do not move as you walk. Most of the rolling must be done before you spread the screenings. After spreading the screenings, water and roll until the mud flushes to the surface. You cannot expect to prevent the stone from kicking out if the teams pass over the road. Keep watch, and in a few days have the roller pass once or twice over the road, after watering, until the loose stones are pressed down out of sight.

61. Before spreading any broken stone, great care must be taken to have the sub-grade carefully shaped and thoroughly compacted.

62. All shoulders must be shaped and left sufficiently high to roll to the proper grade before any broken stone is spread on the road.

63. In the case of heavy fills you must not run the roller to the edge of the shoulders unless the fill has had time to settle. Work out slowly on this kind of work.

64. In every case the screenings used on the surface as a binder course must be of the same material as the top course of the road.

65. Excepting where it may be needed to compact hard, granitic rocks, as before referred to, you will use water only on the top, or binder, course.

66. You will wet this binder course thoroughly before rolling, but not to the extent of saturating the foundation. You will get better results and prevent the screenings from being picked up by

the wheels of the roller if you apply the water and allow it to settle down below the top surface before passing the roller over it. Too much water, or too little, will give trouble by causing the surface to be picked up.

67. You must not under any conditions roll the screenings while dry.

68. You must not under any conditions allow teams to pass over the road after the screenings are spread and before they are rolled.

69. In case of a deficiency in the water supply, you may have the screenings spread and await a rain before rolling; but in such case the road must be entirely closed to travel, and the rolling must be begun as soon as the road is wet and continue until the section covered with screenings is thoroughly compacted. In such cases it may be necessary to operate the roller day and night, and you must insist on this being done. In case you meet with any difficulty in compacting the stone, and fail to understand the cause, report immediately in writing to the office.

70. You are to keep a correct and accurate account of the cost of rolling both the sub-grade and the broken stone which is placed on the road. If the roller is owned by the municipality or contractor, you are to show the number of hours actually employed in rolling the sub-grade and in rolling the broken stone, the cost of engineer (this may vary, according as he is paid by the day or week), of fuel, of oil, of waste, of water and watering, and of all other expenses properly to be entered under the head of rolling. If the roller is hired by the municipality or contractor, you are to keep, in addition to the above, a record of the cost of transportation from the point of shipment to where the work is being done and the price per day paid for the use of the roller, together with the amount actually paid for the roller by the contractor or municipality. If any repairs are necessary and are made on the roller in either case, data regarding same should be obtained and noted.

Breaking, Weighing, etc.

71. When the contractor breaks the stone used on the road, you are to keep a record of the price per ton paid for the stone delivered at the crusher, the number of tons so delivered and the average length of haul. You are also to keep an account of the hours and the cost per hour of laborers, superintendent, and single and double teams employed in handling the stone from the time of delivery at the crusher until broken.

72. In addition, you are to keep an accurate account of the cost of breaking the stone, the amounts paid the engineer, the cost

of fuel, oil, waste, water or any other item properly entering into such cost, as indicated by bills paid by the contractor. If repairs are necessary to the crusher, a record of the cost of such repairs and the length of time the crusher is thereby stopped. The number of tons of each particular size of stone broken must be accurately recorded.

73. A record of the cost of handling the stone from the time it is broken until it is delivered on the road for rolling must also be kept, showing the details of the cost of "loading," "teaming," "spreading" and "supervision," and other items, if any. The sum total of all these items, added to the cost of "rolling," will give the cost of the stone delivered on the road. In cases where the stone is delivered by rail, a record of the cost of "loading" or "unloading," "teaming," "spreading" and "supervision," as well as any other important items, must be kept in the same manner as when the stone is broken locally, the cost of the stone on the road being figured by adding the cost per ton at the station to the above items and the cost of "rolling."

74. The Chief Engineer has been instructed by the Commissioners not to accept any determination of the quantity of broken stone used except upon actual weights, the weigh-master to be a sworn weigher. You will therefore ascertain if these conditions have been complied with before issuing any certificates for the stone.

75. All scales used for weighing on State highways must be legally sealed before allowing any broken stone to be weighed on them. You must see that the scales are adjusted each day.

76. In all cases, except where stone is shipped by railway, a certificate is to be given each day for all broken stone placed on the road, one slip for each size of stone used. Where the stone is thus shipped, a proper record of the weight of each car-load received and placed on the road, with date of receipt, is to be kept, the weights to be taken from paid freight bills, and duplicates of such paid bills to be secured if possible.

The slips in your stone certificate books are to be used in their order, the lowest numbered first.

Each slip is to be filled out in full, is to state the weight of stone, the size, and must be delivered by the Resident Engineer to the contractor or his authorized agent, after having been duly signed by him. The stubs accompanying the slips are to be filled out in full to agree with the slips or certificates so delivered, and on the inside of the cover at the end of each book the total weight of each kind of stone is to be placed.

When the certificates in a book are all used, the stubs are to be at once sent to the office.

These certificates are to be personally made out by the Resident Engineer, and he is to be held personally responsible for any inaccuracies which may occur in them.

77. If a weigher is employed on the road under your supervision, he is to be paid at the same rate as a laborer, but only on those days when actually engaged in the weighing of broken stone placed on the road, one-half day to be the minimum time to be charged when any work is done.

Telford.

78. Telfording will be used in all cases where the road passes over clay, or wet soil. You will make a careful study of the road, and report in writing to the Chief Engineer where in your opinion telfording is needed, giving a description of the soil, together with the general slope of the adjacent ground. In your report you will note the stations between which the telfording may be needed.

79. Where telford is to be used, you will see that the roadbed is excavated and carefully rolled, and left true and even, corresponding to the cross-section, and twelve (12) inches below the established grade of the finished work. You will then cause to be uniformly spread two (2) inches of gravel over the sub-grade. On this sub-grade you will place a foundation of stones, which may vary in size as follows: four (4) to ten (10) inches in width, six (6) to twenty (20) inches in length, five (5) to six (6) inches in depth (not more than ten (10) per cent. of the stone to less than six (6) inches in depth). The stone must be sound, and of a quality approved by the Chief Engineer.

80. The telford stones shall be placed by hand, vertically, on the broadest edges and lengthwise across the road, so as to form a close, firm pavement. They shall be bound by inserting and driving down, in all places where it is practicable, stone of proper size and shape to wedge them in their proper position. No large stone will be left with a projecting point coming nearer than four (4) inches to the finished grade and cross-section. If any such projection be found, it must be broken off to allow a clear depth of four (4) inches of broken stone.

81. The telfording shall then be rolled with a steam roller, all depressions filled with stone chips or spalls, rolled and left true and even and four (4) inches below the finished grade and cross-section. If a drain is to be put in, it must be finished after the excavation is made and before the gravel is spread.

Drains.

82. Where telfording is used, or where ground water from a side hill may work injury to the road, you will build drains.

83. If the road passes through a cut, you will place a drain on each side.

84. If the road is on a side hill, you will place a drain on the up-hill side only.

85. All drains must be carried to a proper outlet, either to a culvert, to another drain or through the bank.

86. Where it is necessary to extend a drain to an outlet beyond the section needing to be drained, you will lay the pipe with cement joints on such extension, and omit the gravel or stone in the trench.

87. Where a pipe is carried through a bank, the outlet must be protected by masonry, as provided in pipe culverts.

88. All pipe must be laid true to a line and grade, and no pipe is to be laid on a grade of less than three (3) inches in one hundred (100) feet.

89. If in laying out a drain you find the trench is likely to exceed five (5) feet in depth below the finished grade, you will immediately report the conditions in writing to the Chief Engineer.

90. The centre of the pipe in all drains will be placed twelve (12) inches outside of the line of broken stone.

91. When the grade of the finished road is three (3) inches or more to the hundred (100) feet, the bottom of the drain trench must be three and one-half ($3\frac{1}{2}$) feet below the finished surface of the road at that part of the cross-section.

92. The drain trench will be excavated to a width of twelve (12) inches at the bottom and fifteen (15) inches at the top, and should be excavated only as fast as the drain can be finished.

93. On the bottom of this trench you will place two (2) inches of gravel or broken stone which will pass through a one and one-quarter ($1\frac{1}{4}$) inch mesh and not through a one-half ($\frac{1}{2}$) inch mesh.

94. All side drain pipe will be five (5) inch salt-glazed vitrified clay pipe, with bell and spigot joint (unless stated to the contrary in the specifications).

95. The pipe is to be laid on the grade hereinbefore mentioned, with open joints and the bell end toward the rising grade.

96. Gravel or broken stone of the sizes already described will be filled about the pipe and over it for a depth of one (1) foot. This must be carefully tamped about and rammed over the pipe. The remainder of the trench is to be filled with stone which will pass through a three (3) inch and not through a one (1) inch mesh.

Great care must be taken to prevent any sand, silt or earth from getting into the pipe or the interstices of the stone in the trench.

97. The sub-grade of the road is to have a regular slope to the edge of the drain.

98. The price per linear foot includes the cost of trenching and refilling with gravel or broken stone, the cost of the pipe and laying, as well as all incidental work.

99. No allowance will be made on extra size of pipe in any drain unless the larger pipe has been ordered in writing by the Chief Engineer.

Gutters.

100. Paved gutters will be built where directed by the Chief Engineer.

101. No gutter is to be laid until after the broken stone has been rolled.

102. In no case is the roller to pass over any part of any paved gutter.

103. Gutters not exceeding four hundred (400) feet in length shall be three (3) feet wide with a shoulder one (1) foot wide and a dish of three (3) inches.

Gutters exceeding four hundred (400) feet in length shall increase the dish above this length at the rate of one (1) inch to each three hundred (300) feet.

104. All stone used in gutters shall be rounded field, bank or river stone; no flat, shaky or rotten stone shall be used.

105. The stone may on the average lay from four (4) to six (6) square yards to the ton. A cubic yard may be estimated to weigh one and one-third ($1\frac{1}{3}$) tons.

106. The larger selected stone will be laid in the gutter itself and on the edges to a true line and grade, with the largest diameters lengthwise of the road. All other stone will be laid with the longest diameters across the gutter.

107. The trench shall be excavated to a depth of twelve (12) inches below the finished grade of the gutter; gravel shall then be spread and rammed to a depth of four (4) inches. A layer of bedding sand or gravel free from stone larger than one-half ($\frac{1}{2}$) inch in diameter shall then be spread of a sufficient thickness to bring the gutter stone which are bedded in it to the proper grade and cross-section after they are thoroughly rammed.

108. Each stone is to be rammed to an unyielding foundation. The surface shall then be covered with sand or screened gravel, which must be well broomed into all joints. The stone shall then be re-rammed and the surface left true and even. Sand or screened

gravel shall then be spread over the entire surface of sufficient depth to fill all interstices.

109. The edge of the gutter toward the road shall be left one-quarter ($\frac{1}{4}$) inch below the surface of the adjoining broken stone; in no case must it project above it.

110. Any broken stone which may be disturbed during the paving of the gutter must be carefully replaced and thoroughly rammed.

111. The bank on the outside of the gutter must be sloped to the gutter, so as to have no bunches or depressions on its surface.

Finishing between Limits.

112. Finishing between limits shall include the cost of removing brush, stone and other unsightly obstructions between tops of excavation and outside limits of location, and between bottoms of slopes and outside limits of location. The smoothing of all slopes in new cuts or fills is to be done at the expense of the contractor.

Fencing used as Guard Rail.

113. Fencing shall be placed wherever necessary to protect travellers from danger. On embankments the fences shall be so placed as to leave all the width possible between them, the posts being placed parallel to the line of broken stone and to conform to finished grade, and set one (1) foot from the edge of the embankment.

114. The posts shall be straight, have all knots hewn down to face, be set with the large end in the ground after having the bottom sawed off square. Care must be taken to so distribute the different sizes that those of similar diameter shall be together. The top and hub rails must each be long enough to extend over three (3) posts, and must break joints.

115. The exposed portions of the fence shall be covered by two (2) coats of lead and oil paint of a medium slate color.

Stone Monuments.

116. Stone bounds are to be set on both sides of the location taken by the State where required; where the length of the tangent is two thousand (2,000) feet or more, bounds are to be set at intervals of one thousand (1,000) feet, and where between one thousand (1,000) and two thousand (2,000) feet, bounds are to be set one-half way between angle points.

117. In cases where the State location includes the whole width of the road, bounds are to be set with the centre of the back edge marking the angle or tangent point, the bounds to show one (1)

foot above the ground where there are no sidewalks, and where sidewalks exist bounds are to be set flush with the grade of the sidewalk. Where the State takes a limited location within the present location of the street, bounds are to be set flush with the sidewalk, the centre of the back edge marking the angle or tangent point as before.

118. Bounds are to be set at all angle points, and at points of curvature and points of tangency of all curves. Where the ground is of a clayey nature, or muck, the material is to be excavated to a proper depth, the diameter of the excavation to be not less than two (2) feet, the excavation to be refilled with gravel or sand and thoroughly tamped.

119. When the bound comes on a ledge, an iron bolt one (1) inch in diameter and eight (8) inches long, set six (6) inches into the ledge, will take the place of the stone monument. In cases where the lay-out begins or ends at the abutment of a bridge, drill holes and bolts will take the place of the stone monuments.

120. The lettered side of the bound stones is to be placed facing the centre of the street.



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representation of the stone to be supplied, to contain one piece three by four inches on one face and to be about two inches thick; the remainder of the stone to be of the *largest* size of stone coming from the crusher.

The blank form below must be filled out and placed in the accompanying envelope, which should be used as the address for the specimen.

It is desired that the stone be shipped in a burlap bag.

Very truly yours,

A. B. FLETCHER,
Clerk of the Commission.

Specimen of Stone for State Highway in the Town of

Sent _____, 189 .

By

Residence,

Locality from which stone comes,

Remarks:

Received _____, 189.

Geologist:

These forms are returned to the laboratory, filled in, and carefully filed away for reference, so that, together with the results of tests and the engineers' reports, sufficient data is furnished for a complete history of the building and maintenance of any road.

The abrasion test, which the commission considers to be of the greatest value up to the present time, has been carried out on all the specimens sent in. The results obtained from these tests are given in the accompanying table, together with the results of last

year, for convenience of comparison. The most notable feature of the results obtained this year is the decided improvement in the quality of stone sent in. It will be seen by referring to the table that several specimens have exceeded in abrasion-resisting power any previously sent in, and that the general average is considerably higher.

Sufficient time has not yet elapsed to ascertain precisely the relation between the abrasion-resisting power of the stone and the wearing quality in actual use on the roads, but the data necessary for that purpose is being collected. The long-continued experience of the French engineers, however, supports the view of the commission that the relation is very close.

Careful microscopic analyses have been made of all the rocks tested, this being necessary for determining the nature of the various rocks, and it also seemed that some relationship might be established between the structure and mineral composition of the rocks and their wearing qualities. A glance at the accompanying table will show that there is such a relation. Of the twenty-five highest results, twenty are diabases (traps), and diabases are generally acknowledged to be the best road metals. It will also be seen that there is a tendency for other varieties of rock to show a like relation in the coefficients of abrasion, and this the writer feels certain would be much more pronounced if good test specimens could always be obtained.

The specific densities of all test specimens (except when there is more than one variety of rock present) are determined, and they can be found in the accompanying table. As yet no distinct relationship can be traced between the specific densities and the wearing properties of the materials.

Hand specimens, three by four inches square, are taken from each test specimen, and they are carefully labelled and placed in a cabinet for reference.

Considerable time has been spent in the endeavor to find satisfactory methods of testing the qualities of road metals other than that ascertained by the abrasion test. The cementation test referred to in last year's report has been the subject of considerable investigation. Before the results of this test could be used with confidence, it was necessary to obtain a standard method of procedure. Before this standard could be obtained, the conduct of the material under different conditions of loading, that is, with different heights of fall of the striking hammer, had to be ascertained. This was done for a large number of stones. The relation between the number of blows required to destroy the briquette, and the height of fall of the hammer, appears from the results so far obtained to be a very simple one. In the specimens

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tested, disintegration occurred after a certain amount of work had been done on the briquette, irrespective (within wide limits) of the height of fall of the hammer. The work along this line of inquiry is not yet completed, but if the above fact continues to hold true it will simplify considerably the problem in hand. The actual results so far obtained are not given here, as it is hoped to present them when the whole investigation is complete.

Another series of investigations has been begun for the purpose of determining the toughness of various kinds of road stone. By this is meant the resistance of the material to a suddenly applied load. The principal loads to which roads are subjected are of this nature. The property to be investigated is practically similar to that already being tested for in the case of cemented stone dust, only the test is carried out on the firm rock itself, and not on the binder. Consequently, a method similar to that already described for the cementing test suggested itself as appropriate. The rock to be tested was sawed into accurately shaped cubes of two centimeters (.78 of an inch) faces. These were subjected to impact, at first under a flat plunger. It was soon found, however, that this did not give the required conditions, so a rounded plunger, which exerts a kind of wedging action, was therefore substituted. The work along these lines has not proceeded far, as the labor required for cutting cubes is considerable, and has all devolved upon one person. If an appropriation were made for an assistant, work of this nature would be greatly expedited. The work so far done gives promise of valuable results. It seems to indicate that the disintegration of the cube does not occur, as in the case of the surfacing material, after a definite amount of work has been done on the rock. An often-repeated light blow produces no appreciable effect on the cube, and it is only when the violence of the blow is increased so as to stress the material beyond its elastic limit that rupture occurs. This point has an important bearing in practice, and explains why roads, such as park roads, subjected to continuous light traffic, wear very slowly, whereas others similarly built and subjected to occasionally heavy traffic rapidly go to pieces.

During the past winter a few determinations were made of the effect of frost upon the volume of compressed stone dust such as is used for the surfacing of roads. Briquettes of the dust were saturated with water, and, after a long exposure considerably below the freezing point, were found, on the average, to have increased in volume by about five-tenths of one per cent. The maximum increase in volume did not exceed one per cent.

Besides the above work, a complete map has been made of the town of Winchester, showing the occurrence of all rock ledges, and giving estimates of all the available road-building stone.

Table showing Specific Densities, Coefficients of Abrasion and Cementing Values of Stones tested.

LOCALITY FROM WHICH STONE COMES.				Specific Den- sity.	Coefficient of Wear.	Name of Stone.	Number of Specimen.	Cementing Value.
37.	IV. (22-N).	Ipswich, Essex Co., Mass.,	.	2.94	24.05	Diabase,	69	1
•	•	Ware, Worcester Co., Mass.,	.	3.00	23.31	Diabase,	73	1
•	•	N E Tran Rock Co., West Springfield, Hampden Co.,	.					
•	•	Co., Monson, Hampden Co., Mass.,	.	2.96	22.14	Diabase,	77	1
31.	VII. (16-V).	Mass.,	.	3.01	22.13	Diabase,	78	1
31.	II. (32-L).	Newton, Middlesex Co., Mass.,	.	3.03	21.22	Diabase,	40	1
36.	VI. (32-G).	Newbury, Essex Co., Mass.,	.	2.80	20.79	Trachyte,	19	1
38.	I. (16-D).	Lynn Essex Co Mass,	.	2.95	20.40	Diabase,	39	1
38.	I. (12-C).	Mass.,	.	3.03	20.37	Diabase,	28	1
•	•	Co., Mass.,	.	3.03	19.77	Diabase,	27	1
31.	VII. (20-V).	Mass.,	.	2.93	19.67	Diabase,	75	1
38.	I. (10-C).	Lynn, Essex Co., Mass,	.	3.03	18.25	Diabase,	35	1
•	•	Lawrence, Essex Co., Mass.,	.	2.99	18.17	Diabase,	36	1
36.	VI. (7-P).	Salisbury Essex Co Mass.,	.	2.76	17.20	Limestone,	74	1
36.	VI. (3-H).	Mass.,	.	2.80	16.76	Camptonite,	43	1
31.	VII. (21-Y).	Mass.,	.	2.72	16.10	Diabase,	47	1
31.	VI. (25-P).	Mass.,	.	3.01	15.08	Diabase,	29	1
31.	VII. (24-W).	Mass.,	.	2.66	16.06	Felsite,	52	23
31.	IV. (31-N).	Mass.,	.	3.01	16.02	Diabase,	32	1
12.	II. (25-R).	Mass.,	.	3.03	15.82	Diabase,	26	1
37.	VI. (31-F).	n Co., Mass,	.	2.96	15.60	Olivene diabase,	16	32
		Mass.,	.	2.92	15.55	Augite diorite,	6	27

38,	III.	(30-K),	J. S. Lane & Son, Meriden, Conn.,	2.83	15.49	Diabase,	81
31,	VI.	(7-B),	Quincy, Norfolk Co., Mass.,	2.96	15.21	Diabase,	24
38,	I.	(12-K),	Haverstraw, N. Y.,	2.92	14.91	Diabase,	61
			Brookline, Norfolk Co., Mass.,	2.99	14.71	Olivene diabase,	30
			Lynn, Essex Co., Mass.,	2.66	14.66	Felsite,	31
			Rockport, Knox Co., Me.,	2.67	14.60	Quartzite,	67
			Montserat Crushing Plant,	2.75	14.58	Hornblende granite,	71
36,	VI.	(29-I),	Newbury. Essex Co., Mass.,	2.94	14.45	Quartz diorite,	45
31,	VIII.	(6-N),	Co., Mass.,	2.87	13.87	Olivene diabase (coarse grained),	14
44,	III.	(26-L),	Co., Mass.,	2.68	13.46	Hornblende granite,	4
			I.,	2.72	13.42	Grit (carboniferous?),	60
31,	VII.	(26-T),	Revere, Suffolk Co., Mass.,	2.65	13.21	Felsite,	15
43,	II.	(32-F),	Gloucester, Essex Co., Mass.,	2.75	12.68	Augite nepheline syenite,	37
			Uxbridge, Worcester Co., Mass.,	2.70	12.62	Hornblende granite,	72
43,	IV.	(34-K),	Rockport, Essex Co., Mass.,	2.63	12.57	Hornblende granite,	44
38,	I.	(12-N),	Meriden, Conn.,	2.83	12.50	Diabase (poor specimen),	17
			Lynn, Essex Co., Mass.,	2.66	12.30	Felsite,	34
26,	VIII.	(23-V),	Chester, Hampden Co., Mass.,	2.82	12.21	Schist,	56
			Waltham, Middlesex Co., Mass.,	2.62	12.16	Hornblende granite,	6
			Lee, Berkshire Co., Mass.,	2.78	12.16	Schist,	53
			Buckland, Franklin Co., Mass.,	2.73	11.71	Schist,	64
			Lee Berkshire Co. Mass.,	2.60	11.65	Quartzite,	9
			Mass.,	-	11.57	Conglomerate,	80
6,	III.	(16-K),	Mass.,	2.92	11.43	Gneiss,	63
31,	VI.	(5-B),	Brookline, Norfolk Co., Mass.,	2.87	11.40	Hornblende diorite,	21
43,	II.	(24-U),	Gloucester, Essex Co., Mass.,	2.64	11.03	Hornblende granite,	33
			Northampton Hampshire Co., Mass.,	2.74	10.69	Hornblende granite,	10
32,	VII.	(3-P),	Ches	3.74	10.62	Magnetite corundum gneiss,	58
			Quir	2.66	10.16	Hornblende granite,	22

* Tests made this year.

Table showing Specific Densities, etc. — Concluded.

LOCALITY FROM WHICH STONE COMES.		Specific Den.	Coef. of Wear.	Name of Stone.	Number of Specimen.	Commin- g Value.
•	Plymouth, Plymouth Co., Mass.,	—	10.10	Field stone (erratics),	42	11
•	Providence, R. I.,	2.66	10.02	Grit (carboniferous?),	46	12
•	13, IX. (1-R), Orange, Franklin Co., Mass.,	2.69	9.78	Hornblende granite,	51	—
•	Pittsfield, Berkshire Co., Mass.,	2.77	9.77	Mica schist,	79	—
•	Providence, R. I.,	2.70	9.57	Grit (carboniferous?),	55	—
•	3, IV. (23-T), Great Barrington, Berkshire Co., Mass.,	2.86	9.52	Limestone,	59	—
•	2, VII. (28-D),	—	9.47	Field stone (erratics),	23	—
•	31, V. (14-T),	3.61	9.42	Peridotite,	49	—
•	ass.,	2.82	9.38	Limestone,	3	15
•	ass.,	2.86	9.28	Diabase (very coarse grained),	25	34
•	ass.,	—	9.09	Field stone (erratics),	11	—
•	ass.,	2.62	9.07	Quartzite,	54	9
•	ass.,	2.74	9.00	Limestone,	66	—
•	ass.,	2.70	8.99	Hornblende granite,	38	—
•	ass.,	—	8.88	Field stone (erratics),	41	9
•	ass.,	—	8.78	Field stone (erratics),	13	—
•	ass.,	—	8.67	Conglomerate,	20	14
•	ass.,	2.75	8.48	Slate (Cambrian?),	8	29
•	Somerville, Middlesex Co., Mass.,	2.67	8.41	Granite,	68	—
•	Ashby, Middlesex Co., Mass.,	2.34	8.35	Chert,	50	—
•	Gordon Co., Ga.,	2.86	8.26	Limestone,	65	—
•	Rockport, Knox Co., Me.,	2.84	8.04	Schist,	2	27
•	2, VIII. (24-R), Lenox, Berkshire Co., Mass.,	2.96	7.94	Hornblende gneiss,	62	8
•	10, II. (26-B), Buckland, Franklin Co., Mass.,	—	—	—	—	—

* 2, IX. (15-Z), Lee, Berkshire Co., Mass.,	Tomkin's Cove, N. Y.,	.	.	.	.	2.84	7.84	Limestone (siliceous),	.	.	57	16
	Holden, Worcester Co., Mass.,	.	.	.	.	-	6.58	Field stone (erratics),	.	.	18	-
	Tomkin's Cove, N. Y.,	.	.	.	.	2.78	6.31	Limestone (siliceous),	.	.	7	-
	Whitman, Plymouth Co., Mass.,	.	.	.	.	-	5.93	Field stone (erratics),	.	.	12	-
	Paxton, Worcester Co., Mass.,	.	.	.	.	2.83	5.01	Granitoid gneiss,	.	.	48	-
		.	.	.	.	2.74	2.85	Marble,.	.	.	1	-
			

* Tests made this year.

The first arabic numeral preceding the name of the locality indicates the sheet of the United States geological survey map of Massachusetts; the roman numeral, one of the nine sections into which the map is divided; the number and letter in parentheses, the exact location whence the specimen came. In this last method of indicating, each section of the map is divided vertically into twenty-six divisions, designated by the letters of the alphabet, and horizontally into thirty-four divisions, which are indicated by numbers.

It seems well to retain these note-book indications for the reason that they afford a tolerably accurate and quite permanent record as to the site of the specimens that have been tested.

LOGAN WALLER PAGE,
Geologist.

APPENDIX H.

SHOWING THE ACTS AND RESOLVES UNDER WHICH
THE WORK OF THE COMMISSION IS CARRIED
ON.

[ACTS OF 1893, CHAPTER 476.]

AN ACT TO PROVIDE FOR THE APPOINTMENT OF A HIGHWAY COMMISSION TO IMPROVE THE PUBLIC ROADS AND TO DEFINE ITS POWERS AND DUTIES.

Be it enacted, etc., as follows :

SECTION 1. The governor, with the advice and consent of the council, shall, within thirty days after the passage of this act, appoint three competent persons, to serve as the Massachusetts Highway Commission. Their terms of office shall be so arranged and designated at the time of their appointment that the term of one member shall expire in three years, one in two years and one in one year. The full term of office thereafter shall be for three years, and all vacancies occurring shall be filled by the governor, with the advice and consent of the council. The members of said board may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall express in the order of removal. They shall each receive in full compensation for their services an annual salary of two thousand dollars, payable in equal monthly instalments, and also their travelling expenses. They may expend annually for clerk hire, engineers and for defraying expenses incidental to and necessary for the performance of their duties, exclusive of office rent, the sum of two thousand dollars. They shall be provided with an office in the state house or some other suitable place in the city of Boston, in which the records of their office shall be kept. They may establish rules and regulations for the conduct of business and for carrying out the provisions of this act. .

SECT. 2. They shall from time to time compile statistics relating to the public roads of cities, towns and counties, and make such investigations relating thereto as they shall deem expedient. They may be consulted at all reasonable times, without charge, by officers of counties, cities or towns having the care of and authority over public roads, and shall without charge advise them relative

to the construction, repair, alteration or maintenance of the same ; but advice given to them by any such officers shall not impair the legal duties and obligations of any county, city or town. They shall prepare a map or maps of the Commonwealth on which shall be shown county, city and town boundaries and also the public roads, particularly the state highways, giving, when practicable, the names of the same. They shall collect and collate information concerning the geological formation of this Commonwealth, so far as it relates to the material suitable and proper for road building, and shall, so far as practicable, designate on said map or maps the location of such material. Such map or maps shall at all reasonable times be open for the inspection of officers of counties, cities and towns having the care of and authority over public roads. They shall each year hold at least one public meeting in each county for the open discussion of questions relating to the public roads, due notice of which shall be given in the press or otherwise.

SECT. 3. They shall make an annual report to the legislature of their doings and the expenditures of their office, together with such statements, facts and explanations bearing upon the construction and maintenance of public roads, and such suggestions and recommendations as to the general policy of the Commonwealth in respect to the same as may seem to them appropriate. Their report shall be transmitted to the secretary of the Commonwealth on or before the first Wednesday in January of each year, to be laid before the legislature. All maps, plans and statistics collected and compiled under their direction shall be preserved in their office.

SECT. 4. County commissioners and city and town officers having the care of and authority over public roads and bridges throughout the Commonwealth shall, on request, furnish the commissioners any information required by them concerning the roads and bridges within their jurisdiction.

SECT. 5. For the purpose of carrying out the provisions of this act said commission may expend such sums for necessary assistants, the procuring of necessary supplies, instruments, material, machinery and other property, and for the construction and maintenance of state highways, as shall from time to time be appropriated by the legislature ; and they shall in their annual report state what sums they deem necessary for the year commencing with the first day of March following.

SECT. 6. [*Repealed.*] Whenever the county commissioners of a county adjudge that the common necessity and convenience require that the Commonwealth acquire as a state highway a new or an existing road in that county, they may apply by petition in

writing to the Massachusetts highway commission, stating the road they recommend, and setting forth a detailed description of said road by metes and bounds, together with a plan and profile of the same. Said commission shall consider such petition, and if they adjudge that it ought to be allowed, they shall in writing so notify said county commissioners. It shall then become the duty of said county commissioners to cause said road to be surveyed and laid out in the manner provided for the laying out and alteration of highways, the entire expense thereof to be borne and paid by said county. Said county commissioners shall preserve a copy of such petition, plans and profiles with their records for public inspection. When said commission shall be satisfied that said county commissioners have properly surveyed and laid out said road, and set in place suitable monuments, and have furnished said commission with plans and profiles, on which shall be shown such monuments and established grades, in accordance with the rules and regulations of said commission, said commission may approve the same, and so notify in writing said county commissioners. Said commission shall then present a certified copy of said petition on which their approval shall be indicated, together with their estimates for constructing said road and the estimated annual cost for maintaining the same, to the secretary of the Commonwealth, who shall at once lay the same before the legislature, if it is in session, otherwise on the second Wednesday of January following. If the legislature makes appropriation for constructing said road, said commission shall cause said road to be constructed in accordance with this act, and when completed and approved by them said road shall become a state highway, and thereafter be maintained by the Commonwealth under the supervision of said commission.

SECT. 7. [*Repealed.*] Two or more cities or towns may petition the said commission representing that, in their opinion, the common necessity and convenience require that the Commonwealth should acquire as a state highway a new or an existing road leading from one city or town to another, which petition shall be accompanied by a detailed description of such road by metes and bounds, and also a plan and profile of the same. If said commission adjudge that the common necessity and convenience require such road to be laid out and acquired as a state highway, they shall cause a copy of said petition, on which shall be their finding, to be given to the county commissioners of the county in which said road or any portion of it lies. It shall then become the duty of the county commissioners, at the expense of the county, to cause said road to be surveyed and laid out, and to set in place suitable monuments and to cause a detailed description by metes

and bounds, plans and profiles to be made, on which shall be shown said monuments and established grades, and to give the same to said commission; but said county commissioners shall have the right to change the line of said road, provided the termini are substantially the same. Said county commissioners shall preserve said petition and a copy of the plans and profiles, with their records, for public inspection. When said commission shall be satisfied that the county commissioners have properly surveyed and laid out said road and set in place suitable monuments, and have furnished them with plans and profiles on which shall be shown said monuments and established grades, in accordance with the rules and regulations of said commission, they shall then proceed in the same manner as provided in section six of this act; and when said road is completed, and approved by said commission, it shall become a state highway, and thereafter be maintained by the Commonwealth under the supervision of said commission.

SECT. 8. [*Repealed.*] In all cases where a highway is to be constructed at the expense of the Commonwealth as a state highway, all the grading necessary to make said highway of the established grade, and the construction of culverts and bridges, shall be paid for by the county or counties, respectively, in which said highway or any portion of it lies, and the work must be done to the satisfaction of said commission. No action by a person claiming damage for the taking of land or change of grade, under the provisions of this act, shall be commenced against a county until said commission has taken possession for the purpose of constructing such state highway.

SECT. 9. [*Repealed.*] When appropriation has been made by the legislature for the construction of a state highway, said commission shall at once cause plans and specifications to be made and estimate the cost of the construction of such state highway, and give to each city and town in which said road lies, a certified copy of said plans and specifications, with a notice that said commission is ready for the construction of said road. Such city or town shall have the right, without advertisement, to contract with said commission for the construction of so much of such highway as lies within its limits, in accordance with the plans and specifications of the commission and under its supervision and subject to its approval, at a price agreed upon between said commission and said city or town; but such price agreed upon shall not exceed eighty-five per cent. of the original estimate of said commission. If such city or town shall within thirty days not elect to so contract, said commission may advertise in one or more papers published in the county where the road or portion of it is situated,

and in one or more papers published in Boston, for bids for the construction of said highway in accordance with the plans and specifications furnished by said commission, and under their supervision and subject to their approval. Said commission shall have the right to reject any and all bids, and they shall require of the contractor a bond for at least ten thousand dollars for each mile of road, to indemnify such city or town in which such highway lies against damage while such road is being constructed, and the Commonwealth shall not be liable for any damage occasioned thereby. Said commission shall make and sign all contracts in the name of the Massachusetts highway commission.

SECT. 10. For the maintenance of state highways, said commission shall contract with the city or town in which such state highway lies, or a person, firm or corporation, for the keeping in repair and maintaining of such highway, in accordance with the rules and regulations of said commission, and subject to their supervision and approval, and such contracts may be made without previous advertisement.

SECT. 11. [*Repealed.*] All contracts made by or with the Massachusetts highway commission under the provisions of this act shall be subject to the approval of the governor and council.

SECT. 12. No length of possession, or occupancy of land within the limit of any state highway, by an owner or occupier of adjoining land, shall create a right to such land in any adjoining owner or occupant or a person claiming under him, and any fences, buildings, sheds or other obstructions encroaching upon such state highway shall, upon written notice by said commission, at once be removed by the owner or occupier of adjoining land, and if not so removed said commission may cause the same to be done and may remove the same upon the adjoining land of such owner or occupier.

SECT. 13. [*Repealed.*] The Commonwealth shall be liable for injuries to persons or property occurring through a defect, or want of repair or of sufficient railing, in or upon a state highway.

SECT. 14. Cities and towns shall have police jurisdiction over all state highways, and they shall at once notify in writing the state commission or its employees of any defect or want of repair in such highways. No state highway shall be dug up for laying or placing pipes, sewers, posts, wires, railways or other purposes, and no tree shall be planted or removed or obstruction placed thereon, except by the written consent of the superintendent of streets or road commissioners of a city or town, approved by the highway commission, and then only in accordance with the rules and regulations of said commission; and in all cases the work shall be executed under the supervision and to the satisfaction of said com-

mission, and the entire expense of replacing the highway in as good condition as before shall be paid by the parties to whom the consent was given or by whom the work was done; but a city or town shall have the right to dig up such state highway without such approval of the highway commission where immediate necessity demands it, but in all such cases such highways shall be at once replaced in as good condition as before, and at the expense of the city or town. Said commission shall give suitable names to the state highways, and they shall have the right to change the name of any road that shall have become a part of a state highway. They shall cause to be erected, at convenient points along state highways, suitable guide posts.

SECT. 15. The word "road," as used in this act, includes every thoroughfare which the public has a right to use.

SECT. 16. This act shall take effect upon its passage. [*Approved June 10, 1893.*]

[ACTS OF 1894, CHAPTER 497.]

AN ACT RELATING TO STATE HIGHWAYS.

Be it enacted, etc., as follows:

SECTION 1. Whenever the county commissioners of a county, or the mayor and aldermen of a city, or the selectmen of a town, adjudge that the public necessity and convenience require that the Commonwealth take charge of a new or an existing road as a highway, in whole or in part, in that county, city or town, they may apply by a petition in writing to the Massachusetts highway commission, stating the road they recommend, together with a plan and profile of the same.

SECT. 2. Said highway commission shall consider such petition and determine what the public necessity and convenience require in the premises, and, if they deem that the highway should be laid out or be taken charge of by the Commonwealth, shall file a plan thereof in the office of the county commissioners of the county in which the petitioners reside, with the petition therefor and a certificate that they have laid out and taken charge of said highway in accordance with said plan, and shall file a copy of the plan and location of the portion lying in each city or town in the office of the clerk of said city or town, and said highway shall, after the filing of said plans, be laid out as a highway, and shall be constructed and kept in good repair and condition as a highway by the said commission, at the expense of the Commonwealth, and shall be known as a state road, and thereafter be maintained by the Com-

monwealth under the supervision of said commission. And all openings and placing of structures in any such road shall be done in accordance with a permit from said commission.

SECT. 3. The damages sustained by any person whose property is taken for, or is injured by the construction of any such highway shall be paid by the Commonwealth, the same to be determined by said commission. And if said commission and the person sustaining the damages cannot agree thereon he or they may have said damages determined by a jury in the county in which the land is situated, by filing a petition for such jury in the office of the clerk of the superior court for said county at any time before the expiration of one year from the completion of said highway, and thereupon said damages shall be determined by a jury at the bar of said court in the same manner as damages for the taking of land for other highways in the county, city or town are determined; and costs shall be taxed to the prevailing party on such petition, as in civil cases.

SECT. 4. Said commission shall, when about to construct any highway, give to each city and town in which said highway lies a certified copy of the plans and specifications for said highway, with a notice that said commission is ready for the construction of said road. Such city or town shall have the right, without advertisement, to contract with said commission for the construction of so much of such highway as lies within its limits, in accordance with the plans and specifications, and under its supervision and subject to its approval, at a price agreed upon between said commission and said city or town. If said city or town shall not elect to so contract within thirty days said commission shall advertise in two or more papers published in the county where the road or a portion of it is situated, and in three or more daily papers published in Boston, for bids for the construction of said highway under their supervision and subject to their approval, in accordance with plans and specifications to be furnished by said commission. Such advertisements shall state the time and place for opening the proposals in answer to said advertisements, and reserve the right to reject any and all proposals. All such proposals shall be sealed and shall be kept by the board, and shall be open to public inspection after said proposals have been accepted or rejected. Said commission may reject any or all bids, or if a bid is satisfactory they shall, with the approval of the governor and council, make a contract in writing on behalf of the Commonwealth for said construction, and shall require of the contractor a bond for at least twenty-five per cent. of the contract price to indemnify any city or town in which such highway lies against

damage while such road is being constructed; and the Commonwealth shall not be liable for any damage occasioned thereby. All construction of state roads shall be fairly apportioned by said commission among the different counties, and not more than ten miles of state road shall be constructed in any one county in any one year on petition as aforesaid, without the previous approval thereof in writing by the governor and council.

SECT. 5. One quarter of any money expended under the provisions of this act in any county for a highway, with interest on said quarter at the rate of three per cent. per annum, shall be repaid by said county to the Commonwealth, in such reasonable sums and at such times within six years thereafter as said commission, with the approval of the state auditor, shall determine, taking into consideration the financial condition of the county; and the treasurer and receiver-general shall apply all money so repaid to the appropriation to be expended by said commission. The county treasurer, with the approval of the county commissioners may make such loans as they may see fit to meet this expenditure.

SECT. 6. Any city or town in which a state highway is situated shall be liable for injuries to persons travelling upon a state highway the same as upon other highways, but the amount actually recovered as damages for such injuries shall be repaid within one year thereafter to such city or town by the Commonwealth. A city or town may make temporary necessary repairs of a state highway without the approval of said commission.

SECT. 7. Said commission shall keep all state roads reasonably clear of brush, and shall cause suitable shade trees to be set out along said highways when feasible, and shall renew the same when necessary, and may also establish and maintain watering troughs at suitable places along said highways.

SECT. 8. For the purpose of meeting any expenses that may be incurred under the provisions of chapter four hundred and seventy-six of the acts of the year eighteen hundred and ninety-three, as hereby amended, including the salaries and expenses of the commission, the treasurer and receiver-general is hereby authorized, with the approval of the governor and council, to issue scrip or certificates of indebtedness to an amount not exceeding three hundred thousand dollars, for a term not exceeding thirty years. Said scrip or certificates of indebtedness shall be issued as registered bonds or with interest coupons attached, and shall bear interest not exceeding four per centum per annum, payable semi-annually on the first days of April and October in each year. Such scrip or certificates of indebtedness shall be designated on

the face as the State Highway Loan, shall be countersigned by the governor, and shall be deemed a pledge of the faith and credit of the Commonwealth, and the principal and interest shall be paid at the times specified therein in gold coin of the United States or its equivalent; and said scrip or certificates of indebtedness shall be sold and disposed of at public auction or in such other mode and at such times and prices and in such amounts and at such rates of interest, not exceeding the rate above specified, as shall be deemed best. The treasurer and receiver-general shall, on issuing any of said scrip or certificates of indebtedness, establish a sinking fund for the payment of said bonds, into which shall be paid any premiums received on the sale of said bonds, and he shall apportion thereto from year to year, in addition, amounts sufficient with the accumulations to extinguish at maturity the debt incurred by the issue of said bonds. The amount necessary to meet the annual sinking fund requirements and to pay the interest on said bonds shall be raised by taxation from year to year.

SECT. 9. Sections six, seven, eight, nine, eleven and thirteen of chapter four hundred and seventy-six of the acts of the year eighteen hundred and ninety-three are hereby repealed.

SECT. 10. This act shall take effect upon its passage. [*Approved June 20, 1894.*]

[ACTS OF 1895, CHAPTER 347.]

AN ACT RELATIVE TO THE CONSTRUCTION OF STATE HIGHWAYS.

Be it enacted, etc., as follows:

SECTION 1. The Massachusetts highway commission is hereby authorized to expend a sum not exceeding four hundred thousand dollars for the construction of state highways during the current year, in accordance with the provisions of chapter four hundred and seventy-six of the acts of the year eighteen hundred and ninety-three and chapter four hundred and ninety-seven of the acts of the year eighteen hundred and ninety-four.

SECT. 2. No persons except citizens of this Commonwealth shall be employed on the work authorized by this act.

SECT. 3. For the purpose of meeting any expenses which may be incurred under the provisions of this act the treasurer and receiver-general is hereby authorized, with the approval of the governor and council, to issue scrip or certificates of indebtedness to an amount not exceeding four hundred thousand dollars, for a term not exceeding thirty years. Said scrip or certificates of indebtedness shall be issued as registered bonds or with interest coupons

attached, and shall bear interest not exceeding four per cent. per annum, payable semi-annually on the first days of April and October in each year. Such scrip or certificates of indebtedness shall be designated on their face as the State Highway Loan, shall be countersigned by the governor, and shall be deemed the pledge of the faith and credit of the Commonwealth; and the principal and interest thereof shall be paid at the times specified therein in gold coin of the United States or its equivalent; and said scrip or certificates of indebtedness shall be sold and disposed of at public auction, or in such other manner, at such times and prices, in such amounts and at such rates of interest not exceeding the rate above specified, as shall be deemed best. The sinking fund established by chapter four hundred and ninety-seven of the acts of the year eighteen hundred and ninety-four shall also be maintained for the purpose of extinguishing bonds issued under the authority of this act, and the treasurer and receiver-general shall apportion thereto from year to year an amount sufficient with the accumulations of said fund to extinguish at maturity the debt incurred by the issue of said bonds. The amount necessary to meet the annual sinking fund requirements and to pay the interest on said bonds shall be raised by taxation from year to year.

SECT. 4. This act shall take effect upon its passage. [*Approved May 1, 1895.*]

[RESOLVES OF 1896, CHAPTER 86.]

RESOLVE RELATIVE TO A STATE HIGHWAY BETWEEN THE CITY OF BOSTON AND THE CITY OF NEWBURYPORT.

Resolved, That the Massachusetts Highway Commission consider the expediency of laying out a state highway between the city of Boston and the city of Salem or the city of Newburyport, over the shore route, so-called, which route may be described substantially as follows:—

Starting from the south ferry, at Lewis street, in Boston, thence through Lewis street to Maverick square, thence through Maverick square to Chelsea street, thence over Chelsea street to Bennington street, thence over Bennington street to Orient Heights, thence over the main traveled road to the town of Revere, continuing on the main road to Beachmont, continuing over the main traveled road, known as Ocean avenue, along the ocean front to the Point of Pines, crossing the Saugus river on the easterly side of the Boston, Revere Beach and Lynn railroad and running to the south end of Sea street in Lynn, thence through Sea street to Broad

street, thence through Broad street to Lewis street, thence through Lewis street to New Ocean street, thence through New Ocean street to the town of Swampscott, thence through New Ocean street, in Swampscott, to the junction of Burrill street and Paradise road, thence over Paradise road to the northeast end of said road, thence through Paradise woods on nearly a straight line to Vinin square, at the junction of the towns of Swampscott and Marblehead and the city of Salem, thence northerly to Loring avenue in the city of Salem, thence over Loring avenue to Lafayette street, thence over Lafayette street to Central street, thence over Central street to Essex street, thence through Salem to and over Beverly bridge, thence through the city of Beverly, and thence to Newburyport, using the present traveled roads as far as may be, with such additions of new road as may be necessary. Said Massachusetts Highway Commission shall report to the next general court the probable cost of such a highway, with such other information as may be obtained in relation thereto, on or before the thirty-first day of January in the year eighteen hundred and ninety-seven. [Approved April 28, 1896.]

[ACTS OF 1896, CHAPTER 345.]

AN ACT RELATIVE TO STATE HIGHWAYS.

Be it enacted, etc., as follows :

SECTION 1. When a highway is laid out as a state road the Massachusetts highway commission shall construct and maintain that portion of the way between the inside lines of sidewalks upon either side. The sidewalks of said road may be constructed and maintained in accordance with the Public Statutes and amendments thereto, and the provisions of section six of chapter four hundred and ninety-seven of the acts of the year eighteen hundred and ninety-four shall only apply to that portion of the way between the inside lines of sidewalks. The inside lines of sidewalks referred to in this section are those lines which are nearest to the centre of the highway.

SECT. 2. A city or town in which a state road lies shall at its own expense keep such road sufficiently clear of snow and ice so that the same shall be reasonably safe for travel, as now required by the Public Statutes and amendments thereto.

SECT. 3. Instead of filing the original petition with the county commissioners, as now required by section two of chapter four hundred and ninety-seven of the acts of the year eighteen hundred and

ninety-four, it shall hereafter be sufficient to file a certified copy thereof with said county commissioners.

SECT. 4. This act shall take effect upon its passage. [*Approved April 28, 1896.*]

[ACTS OF 1896, CHAPTER 481.]

AN ACT RELATIVE TO THE CONSTRUCTION OF STATE HIGHWAYS.

Be it enacted, etc., as follows:

SECTION 1. The Massachusetts highway commission is hereby authorized to expend a sum not exceeding six hundred thousand dollars for the construction of state highways, in accordance with the provisions of chapter four hundred and seventy-six of the acts of the year eighteen hundred and ninety-three and chapter four hundred and ninety-seven of the acts of the year eighteen hundred and ninety-four.

SECT. 2. No persons except citizens of this Commonwealth shall be employed on the work authorized by this act.

SECT. 3. For the purpose of meeting any expenses which may be incurred under the provisions of this act the treasurer and receiver general is hereby authorized, with the approval of the governor and council, to issue scrip or certificates of indebtedness to an amount not exceeding six hundred thousand dollars, for a term not exceeding thirty years. Said scrip or certificates of indebtedness shall be issued as registered bonds or with interest coupons attached, and shall bear interest not exceeding four per cent. per annum, payable semi-annually on the first day of April and of October in each year. Such scrip or certificates of indebtedness shall be designated on their face as the State Highway Loan, shall be countersigned by the governor, and shall be deemed a pledge of the faith and credit of the Commonwealth; and the principal and interest thereof shall be paid at the times specified therein in gold coin of the United States or its equivalent, and said scrip or certificates of indebtedness shall be sold and disposed of at public auction, or in such other manner, at such times and prices, in such amounts and at such rates of interest, not exceeding the rate above-specified, as shall be deemed best. The sinking fund established by chapter four hundred and ninety-seven of the acts of the year eighteen hundred and ninety-four shall also be maintained for the purpose of extinguishing bonds issued under the authority of this act, and the treasurer and receiver general shall apportion thereto from year to year an amount sufficient with the accumulations of said fund to extinguish at maturity the debt incurred by the issue

of said bonds. The amount necessary to meet the annual sinking fund requirements and to pay the interest on said bonds shall be raised by taxation from year to year.

SECT. 4. This act shall take effect upon its passage. [*Approved June 4, 1896.*]

[ACTS OF 1896, CHAPTER 513.]

AN ACT TO PROVIDE FOR AIDING TOWNS IN THE CONSTRUCTION AND MAINTENANCE OF BETTER ROADS.

Be it enacted, etc., as follows:

SECTION 1. Upon the application to the Massachusetts highway commission of the county commissioners of any county, made at the request of any town of not more than twelve thousand inhabitants within said county, there shall be furnished by said highway commission to said county, at the expense of the Commonwealth, one or more steam rollers, portable stone crushers and such other road machines as the said highway commission may deem necessary for the construction and maintenance of better roads in the town making such request. Such machines shall remain the property of the Commonwealth and shall be managed and maintained under the direction of the county commissioners. The county commissioners shall engage competent engineers and skilled mechanics to operate said machines, who shall be paid from the county treasury such sums for each day's actual services as the county commissioners may determine. The expenses so incurred shall be repaid to the county by the towns using said machines, as apportioned by the county commissioners, in proportion to the time in which such machines were used by them.

SECT. 2. Chapter four hundred and eighty-six of the acts of the year eighteen hundred and ninety-five is hereby repealed.

SECT. 3. This act shall take effect upon its passage. [*Approved June 6, 1896.*]

[ACTS OF 1896, CHAPTER 548.]

AN ACT MAKING APPROPRIATIONS FOR EXPENSES AUTHORIZED BY THE PRESENT LEGISLATURE AND FOR CERTAIN OTHER EXPENSES AUTHORIZED BY LAW.

Be it enacted, etc., as follows:

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For expenses in connection with aiding towns in the construction and maintenance of better roads, as authorized by chapter

five hundred and thirteen of the acts of the present year, a sum not exceeding twelve thousand dollars.

SECT. 2. This act shall take effect upon its passage. [*Approved June 9, 1896.*]

[ACTS OF 1896, CHAPTER 541.]

AN ACT RELATIVE TO STREET RAILWAYS LOCATED ON STATE
HIGHWAYS.

Be it enacted, etc., as follows :

SECTION 1. Whenever in the construction of a state highway it becomes necessary, in the opinion of the Massachusetts highway commission, to change the location, relay or change the grade of that part of any street railway located on said highway, or to place different material between its tracks, or to make any other change in the location and construction of said railway, said commission may, in the manner provided in section twenty-two of chapter one hundred and thirteen of the Public Statutes for making such changes by boards of aldermen and selectmen, order the company owning or operating said railway to make such changes : *provided, however,* that the company shall thereafter enjoy the same rights in the new location that it had in the original location ; and unless the same are made within the time limited by said commission the commission may make said changes, and the cost of making the same, whether by the railway company or by said commission, shall be paid by said commission ; said cost with interest at a rate not exceeding four per cent. per annum, shall be paid by said railway company to the Commonwealth in ten equal annual payments ; and the auditor of the Commonwealth on or before the first day of July in each year shall certify the amount due to the tax commissioner, who shall forthwith demand the same ; and payment shall be made within thirty days thereafter. The claim of the Commonwealth shall have priority over all other claims against said railway company, except for labor, and shall be collected in the same manner as the corporation tax ; but any such company may itself pay for the expenses of said changes at the time of making the same, and may anticipate said annual payments in whole or in part.

SECT. 2. This act shall take effect upon its passage. [*Approved June 9, 1896.*]

APPENDIX I.

SHOWING THE METHOD OF PROCEDURE IN PETITIONING FOR STATE HIGHWAYS.

Section 1, chapter 497 of the Acts of 1894, reads as follows: "Whenever the county commissioners of a county, or the mayor and aldermen of a city, or the selectmen of a town, adjudge that the public necessity and convenience require that the Commonwealth take charge of a new or an existing road as a highway, in whole or in part, in that county, city or town, they may apply by a petition in writing to the Massachusetts highway commission, stating the road they recommend, together with a plan and profile of the same."

Before any action toward laying out and constructing a State highway can be taken by the commission, it is necessary that a petition, signed either by the selectmen of a town, the mayor and aldermen of a city or the county commissioners of a county in which the road lies, accompanied by a plan and profile prepared in accordance with the requirements of the commission, be filed in the highway commissioners' office.

The requirements of the commission in relation to the survey and plans of the roads petitioned for are as follows:—

The plans shall be made on the scale of forty feet to the inch, showing all land lines, owners' names, location of and width between present lines, present fences, walls, bridges and guard rails, location and width of travelled way, and all houses within one hundred feet of the street lines; also a profile, forty feet to the inch horizontal scale and eight feet vertical, stations one hundred feet apart, and cross-sections at every station (the stations as shown on the plan to correspond with the stations shown on profile and cross-sections; i. e., the profile is to indicate the grades on the base line of the survey, and the zero point of cross-sections is to be made on the base line).

The plan, with profile on the same sheet, should be in sections of not more than one mile each, and may be drawn on either brown detail paper or tracing cloth of good quality, the detail paper being preferred.

The cross-sections should be plotted on sheets about three by four feet, and should show the full width of the present location and indicate the side slopes, if any, at least two inches being left between each section as drawn on sheet.

The plans are most convenient if made in sections, each showing a length of one mile.

Following are shown the forms of petitions for State highways, which have been prepared by the Massachusetts Highway Commission, and which may be obtained upon application : —

COMMONWEALTH OF MASSACHUSETTS.

To the Massachusetts Highway Commission.

Respectfully represent your petitioners that they are the county commissioners of the county of _____ ; that your petitioners adjudge that the public necessity and convenience require that the Commonwealth should acquire as a State highway a road leading from _____ in the town — city — of _____ to _____ in the town — city — of _____ in the county of _____ and which is described as follows : —

That your petitioners have caused a survey to be made, and accompany this petition with a plan and profile.

Your petitioners therefore pray that said described road may be acquired as a State highway.

Dated at _____ this _____ day of _____ 189

Board of County Commissioners.

COMMONWEALTH OF MASSACHUSETTS.

To the Massachusetts Highway Commission.

Respectfully represent your petitioners that they are the mayor and aldermen of the city of _____ in the county of _____ ; that your petitioners adjudge that the public necessity and convenience require that the Commonwealth should acquire as a State highway a road leading from _____ in said city, to _____ in the town — city — of _____ in the county of _____ and which is described as follows : —

That your petitioners have caused a survey to be made, and accompany this petition with a plan and profile.

Your petitioners therefore pray that said described road may be acquired as a State highway.

Dated at _____ this _____ day of _____ 189

Mayor.

Board of Aldermen.

COMMONWEALTH OF MASSACHUSETTS.

To the Massachusetts Highway Commission.

Respectfully represent your petitioners that they are the selectmen of the town of _____ in the county of _____ ; that your petitioners adjudge the public necessity and convenience require that the Commonwealth should acquire as a State highway a road leading from _____ in said town, to _____ in the town — city — of _____ in the county of _____ and which is described as follows: —

That your petitioners have caused a survey to be made, and accompany this petition with a plan and profile.

Your petitioners therefore pray that said described road may be acquired as a State highway.

Board of Selectmen.

APPENDIX K.

STATEMENT SHOWING ALL PETITIONS RECEIVED,
WITH LENGTHS OF WAY PETITIONED FOR, AND
LAY-OUTS MADE, TOGETHER WITH SUMMARY
BY COUNTIES.

Barnstable County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Barnstable, ¹ . . .	126	July 31, 1895,	10,548	2.00	-	-	-	-
Barnstable, ² . . .	231	Feb. 13, 1896,	10,560	2.00	-	-	-	-
Bourne, . . .	124	Jan. 29, 1895,	16,125	3.05	-	-	-	-
Brewster, . . .	118	Jan. 15, 1895,	40,982	7.76	5,280	1.00	2,220	.42
Chatham, . . .	155	April 4, 1895,	10,639	2.01	-	-	-	-
Dennis, ¹ . . .	102	Nov. 27, 1894,	22,500	4.27	5,277	1.00	2,288	.43
Dennis, ² . . .	126	Feb. 6, 1895,	17,225	3.26	-	-	-	-
Eastham, . . .	209	Aug. 5, 1895,	34,141	6.47	-	-	-	-
Harwich, . . .	106	Dec. 22, 1894,	26,150	4.95	-	-	-	-
Orleans, . . .	182	May 27, 1895,	10,440	1.98	-	-	-	-
Provincetown, . . .	186	June 4, 1895,	14,790	2.80	-	-	-	-
Sandwich, . . .	98	Nov. 23, 1894,	9,000	1.70	-	-	-	-
Truro, . . .	95	Oct. 22, 1894,	12,478	2.36	12,478	2.36	-	-
Wellfleet, . . .	229	Jan. 30, 1896,	10,203	1.93	-	-	-	-
Yarmouth, ¹ . . .	90	Sept. 28, 1894,	19,634	3.72	10,565	2.00	9,020	1.71
Yarmouth, ² . . .	100	Nov. 26, 1894,	26,900	5.10	10,740	2.04	5,006	.95
Totals, . . .	.	.	292,315	55.36	44,340	8.40	18,534	3.51

Sixteen petitions, in thirteen towns.
Average distance petitioned for, 18,270 feet (3.46 miles).
Twelve lay-outs, in four towns; all lay-outs on town petitions.
Distance laid out, 62,874 feet (11.91 miles); average, 5,240 feet (.99 miles).
Percentage of length laid out to length petitioned for, 21.5.

¹ North county road. ² South county road.

Berkshire County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Adams,	48	July 18, 1894,	12,298	2.83	-	-	-	-
Adams,	279	July 30, 1896,	5,280	1.00	-	-	-	-
Becket,	117	Jan. 12, 1895,	10,560	2.00	-	-	-	-
Berkshire County, ¹	46	July 18, 1894,	12,298	2.83	-	-	-	-
Berkshire County, ²	47	July 18, 1894,	9,018	1.71	5,118	.97	3,177	.60
Berkshire County, ³	82	Aug. 18, 1894,	10,560	2.00	7,640	1.45	2,920	.55
Berkshire County, ⁴	83	Aug. 18, 1894,	5,200	.99	5,188	.98	-	-
Berkshire County, ⁵	170	May 10, 1895,	6,289	1.19	6,200	1.18	-	-
Berkshire County, ⁴	187	June 6, 1895,	5,300	1.00	2,652	.50	2,640	.50
Berkshire County, ⁶	275	July 25, 1896,	5,280	1.00	-	-	-	-
Berkshire County, ⁷	276	July 25, 1896,	5,280	1.00	-	-	-	-
Berkshire County, ⁸	277	July 25, 1896,	5,260	1.00	-	-	-	-
Berkshire County, ⁹	278	July 25, 1896,	5,280	1.00	-	-	-	-
Berkshire County, ⁵	293	Sept. 21, 1896,	8,580	1.62	-	-	2,704	.51
Cheshire, ¹⁰ . . .	277	- -	5,260	1.00	-	-	-	-
Dalton,	26	June 10, 1894,	12,695	2.40	-	-	-	-
Dalton,	176	May 14, 1895,	6,300	1.20	5,459	1.03	-	-
Dalton,	238	April 1, 1896,	6,190	1.17	-	-	2,800	.53
Florida,	74	Aug. 1, 1895,	26,853	5.09	-	-	-	-
Great Barrington, ¹⁰	82	- -	10,560	2.00	7,640	1.45	2,920	.55
Great Barrington,	267	June 18, 1896,	10,282	1.95	-	-	1,243	.24
Hancock, ¹⁰ . . .	170	- -	6,289	1.19	6,200	1.18	-	-
Hancock, ¹⁰ . . .	293	- -	8,580	1.62	-	-	2,704	.51
Hinsdale,	156	April 6, 1895,	5,619	1.06	-	-	-	-
Lee, ¹⁰	83	- -	5,200	.99	5,188	.98	-	-
Lee, ¹⁰	187	- -	5,300	1.00	2,652	.50	2,640	.50
Lee,	252	May 25, 1896,	5,280	1.00	-	-	-	-
Lenox,	178	May 16, 1895,	5,280	1.00	-	-	-	-
Lanesborough, ¹⁰	278	- -	5,280	1.00	-	-	-	-
Monterey,	256	June 5, 1896,	5,900	1.12	-	-	-	-
Mount Washington,	92	Oct. 1, 1894,	8,300	1.58	-	-	-	-
North Adams, ¹⁰	47	- -	9,018	1.71	5,118	.97	3,177	.60
North Adams, . .	254	May 27, 1896,	5,742	1.09	-	-	-	-

¹ See Adams.⁴ See Lee.⁷ See Savoy.¹⁰ On county petition.² See North Adams.⁵ See Hancock.⁸ See Cheshire.³ See Great Barrington.⁶ See Otis.⁹ See Lanesborough.

Berkshire County — Concluded.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Otis, ¹	275	- -	5,280	1.00	-	-	-	-
Pittsfield, ²	78	Aug. 7, 1894,	24,087	4.56	5,280	1.00	-	-
Pittsfield, ³	259	June 10, 1896,	5,900	1.12	-	-	-	-
Richmond, ⁴	198	June 4, 1895,	10,462	1.98	-	-	-	-
Richmond, ⁵	248	May 9, 1896,	5,280	1.00	-	-	-	-
Savoy, ¹	276	- -	5,280	1.00	-	-	-	-
Stockbridge,	186	Feb. 26, 1895,	10,700	2.02	-	-	-	-
West Stockbridge, . .	166	Sept. 30, 1895,	6,146	1.16	-	-	-	-
Williamstown,	145	March 19, 1895,	10,576	2.00	2,797	.53	3,700	.70
Windsor,	36	July 12, 1894,	42,787	8.10	-	-	-	-
Totals, . . . .	.	.	308,564	58.44	40,334	7.64	19,184	3.63

Thirty-three petitions (eleven county, three city, nineteen town), in two cities and twenty towns.
Average distance petitioned for, 9,350 feet (1.77 miles).
Seventeen lay-outs, in two cities and five towns.
Length laid out, 59,518 feet (11.27 miles).
Laid out on county petitions, 38,239 feet (7.24 miles); on city petitions, 5,280 feet (1 mile); on town petitions, 15,999 feet (3.03 miles); average, 3,501 feet (.66 miles).
Percentage of length laid out to length petitioned for, 19.30.

¹ On county petition.	² West Pittsfield road.	³ Dalton road.
⁴ Pittsfield east road.	⁵ Hancock road.	

Bristol County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles	Feet.	Miles.	Feet.	Miles.
Acushnet, ¹ . . .	96	Oct. 24, 1894,	35,500	6.73	-	-	-	-
Acushnet, ² . . .	97	Oct. 24, 1894,	6,326	1.20	-	-	-	-
Attleborough, ³ . . .	183	May 29, 1895,	14,153	2.68	-	-	-	-
Attleborough, ⁴ . . .	184	May 29, 1895,	5,122	.97	-	-	-	-
Attleborough, ⁵ . . .	268	June 18, 1896,	14,246	2.70	-	-	-	-
Berkley, . . .	281	Aug. 3, 1896,	22,728	4.30	-	-	-	-
Bristol County, ⁶ . . .	63	July 24, 1894,	48,070	9.11	15,840	3.00	-	-
Dartmouth, ⁷ . . .	22	July 9, 1894,	24,000	4.54	-	-	-	-
Dighton, ⁸ . . .	150	March 26, 1895,	24,576	4.65	-	-	-	-
Dighton, ⁹ . . .	226	Jan. 2, 1896,	8,261	1.56	-	-	-	-
Easton, . . .	189	March 1, 1895,	39,000	7.39	-	-	-	-
Fairhaven, . . .	31	July 10, 1894,	20,100	3.80	7,653	1.45	-	-
New Bedford, . . .	191	June 18, 1895,	2,950	.56	-	-	-	-
North Attleborough, . . .	18	July 5, 1894,	25,500	4.83	8,792	1.66	5,911	1.12
Raynham, . . .	134	Feb. 23, 1895,	23,000	4.36	-	-	-	-
Rehoboth, . . .	182	Feb. 20, 1895,	29,186	5.53	5,273	1.00	2,920	.55
Seekonk, . . .	127	Feb. 6, 1895,	14,591	2.76	-	-	-	-
Somerset, . . .	147	March 30, 1895,	29,800	5.64	4,517	.86	2,970	.56
Swansea, . . .	235	March 10, 1896,	36,515	6.92	-	-	-	-
Taunton, ¹⁰ . . .	171	May 11, 1895,	25,864	4.89	-	-	-	-
Taunton, ¹¹ . . .	179	May 16, 1895,	23,752	4.50	4,000	.76	2,800	.44
Taunton, ^{12,13} . . .	180	May 19, 1895,	13,200	2.50	-	-	-	-
Westport, ¹⁴ . . .	53	- -	24,070	4.57	15,840	3.00	-	-
Totals, . . .	.	.	456,114	86.38	46,075	8.73	14,101	2.67

Twenty-two petitions (one county, four city and seventeen town), in two cities and fourteen towns.

Average distance petitioned for, 20,733 feet (3.93 miles).

Fourteen lay-outs, in one city and five towns.

Length laid out, 60,176 feet (11.40 miles); average, 4,298 feet (.83 mile). Laid out on county petition, 15,840 feet (3 miles); on town petitions, 33,036 feet (7.20 miles); on city petition, 6,300 feet (1.20 miles).

Percentage of distance laid out to distance petitioned for, 13.19.

¹ New Bedford-Boston road.

² Fairhaven road.

³ Washington Street (turnpike).

⁴ North Avenue.

⁵ Washington and Horton Streets. To Horton Street is duplicate of petition No. 183; Horton Street scales, 7,920 feet (1.50 miles).

⁶ See Dartmouth and Westport.

⁷ Duplicate of county petition.

⁸ Somerset Avenue.

⁹ Providence-Taunton turnpike.

¹⁰ Somerset Avenue and Dean Street.

¹¹ Winthrop Street.

¹² Broadway (Boston Turnpike).

¹³ No plan; distance scaled on map.

¹⁴ On county petition.

Nantucket County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Nantucket, . . .	11	July 3, 1894,	34,185	6.50	13,560	2.58	6,070	1.15

One petition, in one town. Five lay-outs, in one town.
Length laid out, 19,630 feet (3.73 miles).
Percentage of length laid out to length petitioned for, 57.38.

County of Dukes County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Chilmark, . . .	12	July 3, 1894,	41,237	7.81	-	-	-	-
Cottage City, ¹ . .	7	- -	13,117	2.48	10,568	2.00	1,970	.37
Dukes County, ² . .	7	July 2, 1894,	26,217	4.96	10,568	2.00	1,970	.37
Edgartown, ¹ . . .	7	- -	13,100	2.48	-	-	-	-
Tisbury, . . .	3	June 28, 1894,	10,609	2.01	10,194	1.93	-	-
West Tisbury, . .	4	June 28, 1894,	23,441	5.39	5,280	1.00	7,920	1.50
West Tisbury, ³ . .	255	May 29, 1896,	6,212	1.18	-	-	-	-
Totals, . . .	.	. . .	112,716	21.35	26,042	4.93	9,890	1.87

Five petitions (one county and four town), in five towns.
Six lay-outs, in three towns.
Length laid out, 35,932 feet (6.80 miles); average, 6,988 feet (1.13 miles).
Laid out on county petition, 12,538 feet (2.33 miles); on town petitions, 23,394 feet (4.42 miles).
Percentage of length laid out to length petitioned for, 31.85.

¹ On county petition. ² See Cottage City and Edgartown.
³ Petition for change of location.

Essex County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Amesbury, . . .	203	July 22, 1895,	27,997	5.30	-	-	-	-
Andover, . . .	20	July 6, 1894,	31,400	5.95	3,026	.58	3,360	.64
Beverly, ¹ . . .	64	- -	13,900	2.64	7,806	1.47	-	-
Essex County, ² . . .	64	July 30, 1894,	53,800	10.19	7,806	1.47	-	-
Gloucester, ³ . . .	28	July 10, 1894,	9,650	1.83	8,452	1.60	-	-
Gloucester, ^{4,5} . . .	110	Jan. 1, 1895,	54,120	10.25	-	-	-	-
Groveland, . . .	211	Aug. 8, 1895,	23,948	4.53	-	-	-	-
Hamilton, ¹ . . .	64	- -	18,100	3.43	-	-	-	-
Haverhill, . . .	297	Nov. 4, 1896,	13,888	2.63	-	-	-	-
Ipswich, ¹ . . .	64	- -	12,700	2.40	-	-	-	-
Ipswich, ⁶ . . .	239	April 4, 1896,	11,900	2.25	-	-	-	-
Lawrence, ⁵ . . .	76	Aug. 2, 1894,	2,640	.50	-	-	-	-
Lawrence, ^{5,7} . . .	245	May 4, 1896,	4,600	.83	-	-	-	-
Lawrence, ^{5,8} . . .	234	Aug. 25, 1896,	2,300	.44	-	-	-	-
Lawrence, ^{5,9} . . .	235	Aug. 25, 1896,	1,760	.33	-	-	-	-
Lawrence, ¹⁰ . . .	290	Sept. 11, 1896,	1,408	.27	-	-	1,408	.27
Manchester, . . .	167	May 1, 1895,	5,280	1.00	-	-	-	-
Merrimac, . . .	204	July 26, 1895,	15,134	2.87	-	-	-	-
Methuen, . . .	287	Aug. 31, 1896,	20,184	3.82	-	-	5,478	1.04
Newbury, . . .	197	July 2, 1895,	22,333	4.24	-	-	-	-
Newburyport, . . .	196	July 1, 1895,	10,100	1.91	-	-	3,641	.69
North Andover, . . .	272	July 1, 1896,	10,186	1.93	-	-	-	-
Rockport, . . .	135	Feb. 23, 1895,	5,736	1.08	-	-	-	-
Rowley, . . .	242	April 23, 1896,	19,270	3.65	-	-	-	-
Salisbury, . . .	243	April 27, 1895,	10,560	2.00	-	-	-	-
Saugus, . . .	34	July 11, 1894,	8,811	1.67	-	-	-	-
Wenham, ¹ . . .	64	- -	9,100	1.73	-	-	-	-
West Newbury, . . .	101	Nov. 26, 1894,	27,017	5.11	5,211	.99	5,206	.98
West Newbury, . . .	206	July 29, 1895,	4,000	.76	-	-	-	-
Totals, . . .	.	.	398,127	75.40	24,495	4.64	19,093	3.63

Twenty-five petitions (one county, nine city and fifteen town), in five cities and sixteen towns.

Average distance petitioned for, 15,928 feet (3.02 miles).

Ten lay-outs, in four cities and three towns.

Length laid out, 43,588 feet (8.26 miles); average, 4,359 feet (.82 mile). Laid out on county petition, 7,806 feet (1.47 miles); on town petitions, 22,281 feet (4.23 miles); on city petitions, 18,501 feet (2.56 miles).

Percentage of length laid out to length petitioned for, 10.96.

¹ On county petition.

² Western Avenue.

³ No plan; distance scaled on map.

⁴ South Broadway to Andover line.

⁵ Prospect Street to Methuen line.

⁶ See Beverly, Hamilton, Ipswich and Wenham.

⁷ Essex Avenue, Washington Street and Rockport Road.

⁸ North of Ipswich River to Rowley line.

⁹ East Haverhill Street to Methuen line.

¹⁰ Jackson Street.

Hampden County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles	Feet.	Miles.	Feet.	Miles.
Blandford, . . .	216	Sept. 7, 1895,	13,837	2.54	-	-	-	-
Brimfield, ¹ . . .	40	July 6, 1894,	36,870	6.89	-	-	-	-
Brimfield, ^{2,3} . . .	131	- -	9,355	1.77	-	-	-	-
Chester, . . .	104	Dec. 11, 1894,	5,280	1.00	-	-	-	-
Chicopee, . . .	223	Dec. 28, 1895,	5,700	1.08	-	-	-	-
East Longmeadow, .	202	July 11, 1895,	25,426	4.81	-	-	-	-
Granville, . . .	87	Sept. 6, 1894,	9,216	1.75	-	-	-	-
Hampden, . . .	201	July 11, 1895,	18,031	3.41	-	-	-	-
Hampden County, ⁴ .	19	July 6, 1894,	100,480	19.03	24,169	4.58	11,876	2.26
Hampden County, ⁵ .	131	Feb. 12, 1895,	90,064	17.06	5,276	1.00	-	-
Hampden County, ⁶ .	241	April 23, 1896,	2,400	.46	-	-	-	-
Hampden County, ⁷ .	273	July 3, 1896,	5,300	1.00	-	-	-	-
Holyoke, . . .	273	- -	5,300	1.00	-	-	-	-
Ludlow, . . .	236	March 11, 1896,	14,831	2.80	-	-	-	-
Monson, ⁸ . . .	57	July 26, 1894,	14,960	2.83	4,933	.93	-	-
Monson, ^{1,9} . . .	131	- -	6,925	1.31	-	-	-	-
Palmer, ¹ . . .	131	- -	46,034	8.72	-	-	-	-
Russell, ¹ . . .	19	- -	35,380	6.70	12,207	2.31	6,089	1.15
Wales, . . .	41	July 16, 1894,	25,922	4.91	-	-	-	-
Westfield, ¹ . . .	19	- -	40,900	7.75	6,708	1.27	2,987	.57
West Springfield, ¹⁰ .	113	Jan. 8, 1895,	24,200	5.58	5,254	1.00	2,800	.53
West Springfield, ¹ .	241	- -	2,400	.46	-	-	-	-
Wilbraham, ¹ . . .	131	- -	27,750	5.26	5,276	1.00	-	-
Wilbraham, . . .	247	May 8, 1896,	4,140	.78	-	-	3,073	.58
Totals, . . .	.	.	371,457	70.35	34,378	6.51	14,949	2.83

Sixteen petitions (four county, one city and eleven town), in two cities and fourteen towns.
Average distance petitioned for, 23,216 feet (4.40 miles).
Fifteen lay-outs, in five towns.
Length laid out, 49,327 feet (9.34 miles); average, 3,288 feet (.62 mile).
Laid out on county petitions, 41,321 feet (7.82 miles).
Laid out on town petitions, 8,006 feet (1.52 miles).
Percentage of length laid out to length petitioned for, 13.28.

¹ Road to Brimfield Centre.

⁵ River road.

⁶ See Brimfield, Monson, Palmer and Wilbraham.

⁷ See Holyoke.

⁹ River road.

² On county petition.

⁴ See Westfield, Russell and West Springfield.

⁶ See West Springfield (Agawam road).

⁸ Road from Palmer to Monson.

¹⁰ Duplicate of county petition.

Hampshire County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Amherst, . . .	161	May 18, 1895,	5,356	1.02	-	-	-	-
Belchertown, . .	220	Nov. 18, 1896,	5,280	1.00	-	-	-	-
Belchertown, . .	282	Aug. 6, 1896,	5,280	1.00	-	-	-	-
Chesterfield, ¹ . .	123	Feb. 6, 1895,	3,930	.74	-	-	-	-
Cummington, ¹ . .	27	July 10, 1894,	55,053	10.43	-	-	-	-
Easthampton, ² . .	114	Jan. 10, 1896,	5,854	1.11	-	-	-	-
Easthampton, ^{1, 3} . .	189	July 10, 1895,	6,800	1.29	5,280	1.00	1,683	.32
Enfield, . . .	283	Aug. 25, 1896,	9,593	1.81	-	-	-	-
Goshen, ¹ . . .	2	June 23, 1894,	29,480	5.58	10,058	1.91	-	-
Granby, ⁴ . . .	5	- -	3,347	.63	3,347	.63	-	-
Granby, . . .	289	Sept. 9, 1896,	10,700	2.03	-	-	-	-
Greenwich, . . .	295	Oct. 17, 1896,	5,464	1.03	-	-	-	-
Hadley, ¹ . . .	94	Oct. 20, 1894,	5,667	1.08	5,676	1.08	-	-
Hadley, . . .	200	July 11, 1895,	4,133	.78	-	-	2,150	.41
Hadley, . . .	284	Aug. 27, 1896,	14,766	2.80	-	-	-	-
Hampshire County, ⁵ .	5	June 29, 1894,	154,192	29.19	29,998	5.68	4,783	.90
Hatfield, . . .	164	April 23, 1895,	2,500	.47	-	-	-	-
Hatfield, . . .	165	April 23, 1895,	5,280	1.00	-	-	-	-
Huntington, . . .	99	Nov. 24, 1894,	14,408	2.73	8,553	.67	1,783	.34
Middlefield, . . .	177	May 14, 1895,	5,400	1.03	-	-	-	-
Northampton, ¹ . .	67	July 31, 1894,	2,997	.56	2,997	.56	-	-
Northampton, ¹ . .	194	June 25, 1895,	5,280	1.00	-	-	-	-
South Hadley, ⁴ . .	5	- -	15,571	2.95	2,640	.60	-	-
South Hadley, ¹ . .	288	Sept. 3, 1896,	3,816	1.67	-	-	-	-
Southampton, . .	253	May 25, 1896,	5,280	1.00	-	-	-	-
Ware, . . .	205	July 29, 1895,	4,100	.77	-	-	-	-
Williamsburg, ⁴ . .	5	- -	26,063	4.94	-	-	3,100	.68
Williamsburg, ^{1, 6} . .	129	Feb. 6, 1895,	11,908	2.26	-	-	-	-
Williamsburg, ^{1, 7} . .	249	May 11, 1896,	5,695	1.08	-	-	-	-
Totals, . . .	.	.	257,586	48.78	33,551	6.35	8,716	1.65

Twenty-six petitions (one county, two city, twenty-three town), in one city and seventeen towns.

Thirteen lay-outs, in one city and seven towns.

Length laid out, 42,267 feet (8.00 miles). Average length laid out, 3,251 feet (.62 mile).

Average length petitioned for, 9,907 feet (1.88 miles).

Laid out on county petition, 34,781 feet (6.58 miles).

Laid out on town petitions, 7,486 feet (1.42 miles).

Percentage of length laid out to length petitioned for, 16.42.

¹ Duplicate of county petition.

² Holyoke Street.

³ Northampton road

⁴ On county petition.

⁵ See Chesterfield, Cummington, Easthampton, Goshen, Granby, Hadley, Northampton, South Hadley and Williamsburg.

⁶ Chesterfield road.

⁷ Goshen road.

Middlesex County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Acton, ¹	119	Jan. 7, 1895,	9,158	1.73	-	-	-	-
Acton, ¹	138	Feb. 28, 1895,	12,129	2.30	-	-	-	-
Acton, ²	233	- -	21,922	4.15	-	-	-	-
Ashby,	1	June 27, 1894,	18,625	3.58	8,488	1.61	1,200	.23
Ayer,	225	Jan. 1, 1896,	15,548	2.95	-	-	-	-
Bedford,	175	May 14, 1895,	19,636	3.72	-	-	-	-
Billerica,	264	June 13, 1896,	18,490	3.50	-	-	-	-
Boxborough, ²	233	- -	17,508	3.32	-	-	-	-
Carlisle,	109	Dec. 26, 1894,	21,531	4.08	-	-	-	-
Chelmsford, ^{3,4}	50	July 20, 1894,	5,583	1.06	-	-	-	-
Chelmsford, ^{2,12}	266	- -	6,030	1.15	-	-	-	-
Concord,	81	Sept. 11, 1894,	8,550	1.62	-	-	-	-
Dunstable,	291	Sept. 17, 1896,	8,778	1.66	-	-	-	-
Framingham,	303	Dec. 17, 1896,	8,296	1.57	-	-	-	-
Groton, ⁵	105	Dec. 17, 1894,	40,215	7.61	-	-	-	-
Groton, ⁶	219	Nov. 14, 1895,	23,140	4.38	-	-	-	-
Lexington,	79	Aug. 8, 1894,	18,300	3.46	4,020	.76	3,498	.65
Lincoln,	80	Aug. 8, 1894,	10,850	2.05	5,290	1.00	3,561	.68
Lowell, ^{3,4}	55	July 25, 1894,	7,011	1.33	-	-	-	-
Lowell, ²	44	- -	5,248	1.00	-	-	-	-
Littleton,	218	Nov. 14, 1895,	12,110	2.29	-	-	-	-
Marlborough, ⁷	143	March 15, 1895,	12,638	2.40	-	-	-	-
Marlborough, ⁸	271	June 26, 1896,	17,135	3.25	-	-	-	-
Medford, ⁴	265	June 13, 1896,	4,918	.93	-	-	-	-
Middlesex County, ⁹	44	July 17, 1894,	20,800	3.94	7,945	1.50	7,643	1.45
Middlesex County, ¹⁰	45	July 17, 1894,	12,594	2.39	-	-	-	-
Middlesex County, ¹¹	233	Feb. 25, 1896,	89,430	7.47	-	-	-	-
Middlesex County, ¹²	266	June 15, 1896,	6,030	1.15	-	-	-	-
Middlesex County, ¹³	274	July 18, 1896,	11,368	2.15	-	-	-	-
Natick,	251	May 21, 1896,	6,813	1.29	-	-	-	-
North Reading,	107	Dec. 24, 1894,	31,060	5.88	-	-	-	-
Pepperell,	299	Nov. 11, 1896,	18,700	3.54	-	-	-	-

¹ Littleton Road.⁴ Duplicate of county petition.⁷ Northborough road.¹⁰ Chelmsford road.¹³ Medford-Stoneham road.² On county petition.⁵ Fitchburg-Lowell road.⁶ Sudbury road.¹¹ Acton-Boxborough road.¹⁴ Main east and west road.³ Princeton Street.⁸ Great road.⁹ Tyngsborough road.¹² Truant school road.

Middlesex County — Concluded.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles	Feet.	Miles.
Reading, . . .	157	April 10, 1895,	23,100	4.38	-	-	-	-
Sherborn, . . .	250	May 14, 1896,	5,500	1.04	-	-	-	-
Stoneham, ¹ . . .	280	July 30, 1896,	6,450	1.22	-	-	-	-
Sudbury, ² . . .	214	Aug. 24, 1895,	5,800	1.00	-	-	-	-
Sudbury, ² . . .	280	Feb. 16, 1896,	20,409	3.87	-	-	-	-
Tewksbury, . . .	257	June 5, 1896,	14,770	2.80	-	-	-	-
Townsend, . . .	149	March 21, 1895,	16,830	3.19	-	-	3,459	.65
Tyngsborough, ³ . . .	44	- -	15,552	2.94	7,945	1.50	7,643	1.45
Watertown, . . .	151	March 27, 1895,	17,736	3.36	4,019	.76	453	.09
Wayland, . . .	212	Aug. 10, 1895,	15,450	2.93	-	-	-	-
Westford, . . .	116	Jan. 10, 1895,	21,900	4.15	-	-	-	-
Winchester, . . .	244	April 28, 1896,	10,300	1.95	-	-	-	-
Totals, . . .	.	.	573,267	108.57	29,762	5.63	19,814	3.76

Thirty-nine petitions (five county, four city, thirty town), in three cities and twenty-nine towns.

Twelve lay-outs, in six towns.

Average distance petitioned for, 14,698 feet (2.75 miles).

Length laid out, 49,576 feet (9.39 miles): average, 4,131 feet (.78 mile); on county petitions, 15,588 feet (2.95 miles); on town petitions, 33,988 feet (6.44 miles).

Percentage of length laid out to length petitioned for, 8.65.

¹ Duplicate of county petition. ² Main east and west road. ³ On county petitions.

Norfolk County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet	Miles.
Bellingham, . . .	173	May 13, 1895,	3,900	.74	-	-	-	-
Braintree, . . .	116	Jan. 10, 1895,	6,700	1.27	-	-	-	-
Cohasset, . . .	158	April 12, 1895,	11,300	2.14	-	-	-	-
Dedham, . . .	307	Dec. 31, 1895,	3,900	.75	-	-	-	-
Foxborough, ^{1,2} . . .	123	Jan. 29, 1895,	29,040	5.50	-	-	-	-
Foxborough, . . .	163	April 24, 1895,	5,840	1.11	-	-	-	-
Franklin, . . .	296	Nov. 6, 1896,	9,227	1.75	-	-	-	-
Holbrook, . . .	9	July 10, 1894,	11,848	2.24	2,488	.48	3,329	.63
Milton, . . .	190	June 15, 1895,	5,730	1.09	-	-	-	-
Needham, . . .	154	April 2, 1895,	9,050	1.71	-	-	-	-
Norfolk, . . .	88	Sept. 21, 1894,	7,676	1.45	7,676	1.45	-	-
Norwood, . . .	51	July 21, 1894,	18,747	3.55	3,198	.61	2,153	.41
Quincy, ³ . . .	237	March 18, 1896,	9,920	1.88	-	-	-	-
Quincy, ⁴ . . .	292	Sept. 17, 1896,	7,400	1.40	-	-	-	-
Randolph, . . .	208	Aug. 3, 1895,	9,050	1.71	-	-	-	-
Sharon, . . .	159	April 12, 1895,	28,713	5.44	-	-	-	-
Stoughton, . . .	228	Jan. 15, 1896,	20,538	3.89	-	-	-	-
Walpole, . . .	77	Aug. 4, 1894,	30,300	5.74	3,502	1.61	-	-
Weymouth, ⁵ . . .	59	July 27, 1894,	9,400	1.78	2,216	.41	3,921	.75
Weymouth, ⁶ . . .	63	July 30, 1894,	1,330	.25	1,330	.25	-	-
Wrentham, . . .	32	July 10, 1894,	38,150	7.23	8,540	1.62	-	-
Totals, . . .	.	.	277,759	52.61	33,950	6.43	9,403	1.78

Twenty-one petitions (two city and nineteen town), in one city and seventeen towns.
Average distance petitioned for, 13,227 feet (2.50 miles).
Twelve lay-outs, in six towns; all on town petitions.
Length laid out, 43,353 feet (8.21 miles); average, 3,613 feet (.68 mile).
Percentage of length laid out to length petitioned for, 15.61.

¹ Withdrawn; No. 163 substituted.

² No plan; distance scaled on map.

³ Washington Street.

⁴ Randolph Avenue.

⁵ Bridge Street.

⁶ Ann Street.

Plymouth County.

COUNTY, CITY OR TOWN.	No	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles	Feet.	Miles.
Abington, . . .	58	July 27, 1894,	8,700	1.66	-	-	-	-
Abington, . . .	192	June 19, 1895,	10,300	1.95	-	-	-	-
Bridgewater, . . .	217	Nov. 14, 1895,	6,600	1.25	-	-	-	-
Brockton, . . .	61	July 27, 1894,	5,525	1.05	-	-	-	-
Brockton, . . .	270	June 22, 1896,	5,037	.96	-	-	-	-
Duxbury, . . .	70	July 31, 1894,	33,000	6.25	5,540	1.05	-	-
East Bridgewater, . .	240	April 8, 1896,	6,300	1.19	-	-	-	-
Halifax, . . .	54	July 24, 1894,	23,463	4.44	-	-	-	-
Hanover, . . .	66	July 30, 1894,	24,157	4.58	-	-	-	-
Hanson, ¹ . . .	262	June 12, 1896,	5,280	1.00	-	-	-	-
Hanson, ² . . .	263	June 12, 1896,	5,280	1.00	-	-	-	-
Hingham, . . .	8	July 8, 1894,	27,655	5.24	7,505	1.42	3,880	.73
Lakeville, . . .	174	May 14, 1896,	5,300	1.00	-	-	-	-
Marion, . . .	29	July 10, 1894,	27,248	5.16	7,780	1.48	-	-
Marshfield, . . .	71	July 31, 1894,	40,400	7.65	2,640	.50	2,582	.49
Mattapoisett, . . .	30	July 10, 1894,	24,992	4.73	6,134	1.16	-	-
Middleborough, ³ . . .	68	July 31, 1894,	77,169	14.62	7,270	1.37	2,676	.51
Norwell, . . .	246	May 5, 1896,	5,923	1.12	-	-	-	-
Pembroke, . . .	234	Feb. 27, 1896,	5,280	1.00	-	-	-	-
Plymouth, ⁴ . . .	72	July 31, 1894,	90,420	17.13	7,509	1.42	-	-
Plymouth, ⁵ . . .	269	June 22, 1896,	5,846	1.11	-	-	5,846	1.11
Plympton, . . .	121	Jan. 22, 1895,	5,380	1.02	-	-	-	-
Rochester, . . .	172	May 13, 1895,	22,108	4.19	-	-	-	-
Rockland, . . .	75	Aug. 1, 1894,	6,900	1.30	-	-	-	-
Scituate, . . .	69	July 31, 1894,	28,500	5.39	6,139	1.17	-	-
Wareham, . . .	42	July 16, 1894,	60,100	11.38	-	-	3,014	.67
West Bridgewater, . .	221	Dec. 4, 1895,	17,100	3.24	-	-	-	-
Whitman, . . .	65	July 30, 1894,	8,900	1.68	7,883	1.49	1,074	.20
Totals, . . .	.	. . .	592,863	112.28	58,400	11.06	19,072	3.61

Twenty-eight petitions (two city and twenty-six town), in one city and twenty-three towns.
Average distance petitioned for, 21,174 feet (4.01 miles).
Length laid out, 77,472 feet (14.67 miles); average, 3,228 feet (.61 mile).
Twenty-five lay-outs, in ten towns; all lay-outs have been made on town petitions.
Percentage of distance laid out to distance petitioned for, 13.06.

¹ Main Street.

² Whitman Street.

³ Plan for 10,732 feet; balance scaled on map.

⁴ Plan for 8,211 feet; balance scaled on map. Shore road.

⁵ Pine Hills road.

Suffolk County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Chelsea,	56	July 25, 1894,	6,000	1.14	-	-	-	-
Revere,	60	July 27, 1894,	11,475	2.17	-	-	-	-
Winthrop,	73	July 31, 1894,	18,100	3.42	-	-	-	-
Totals,			35,575	6.73	-	-	-	-

Three petitions, in one city and two towns. No lay-outs.

Worcester County.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Athol,	37	July 12, 1894,	16,800	3.18	5,280	1.00	3,195	.61
Auburn,	148	March 20, 1895,	12,100	2.29	4,004	.76	2,900	.55
Barre,	146	March 19, 1895,	15,286	2.89	-	-	-	-
Blackstone,	140	March 2, 1895,	7,700	1.46	-	-	-	-
Bolton,	185	June 3, 1895,	5,280	1.00	-	-	-	-
Brookfield,	111	Jan. 2, 1895,	5,972	1.13	-	-	-	-
Brookfield,	300	Nov. 27, 1896,	22,025	4.17	-	-	-	-
Charlton,	261	June 11, 1896,	10,700	2.03	-	-	-	-
Dana,	294	Sept. 24, 1896,	10,560	2.00	-	-	-	-
Fitchburg, ¹	17	July 5, 1894,	5,493	1.04	5,133	.97	-	-
Fitchburg, ²	62	July 30, 1894,	20,800	3.94	-	-	-	-
Fitchburg, ^{3, 4}	93	Oct. 3, 1894,	10,560	2.00	-	-	-	-
Gardner,	13	July 3, 1894,	29,656	5.62	-	-	-	-
Grafton,	213	Aug. 15, 1895,	16,971	3.21	-	-	-	-
Hardwick,	207	July 31, 1895,	5,357	1.01	-	-	-	-
Harvard,	260	June 11, 1896,	25,775	4.88	-	-	-	-
Holden,	10	July 3, 1894,	27,920	5.29	7,811	1.48	3,386	.64
Hopedale,	144	March 16, 1895,	6,040	1.14	-	-	-	-
Hubbardston,	232	Feb. 24, 1896,	10,560	2.00	-	-	-	-
Lancaster,	137	Feb. 28, 1895,	24,808	4.70	-	-	-	-
Leicester,	25	July 9, 1894,	28,110	5.32	10,608	2.01	3,310	.63
Leominster, ⁴	91	Sept. 26, 1894,	26,400	5.00	-	-	-	-
Lunenburg,	16	July 5, 1894,	30,772	5.83	-	-	-	-

¹ Westminster road. ² Ashby road.
³ Leominster road. ⁴ No plan; distance scaled on map.

Worcester County—Concluded.

COUNTY, CITY OR TOWN.	No.	Petition dated—	LENGTH PETITIONED FOR.		LENGTH LAID OUT.			
					1894-95.		1896.	
			Feet.	Miles.	Feet.	Miles.	Feet.	Miles.
Mendon, . . .	84	Aug. 20, 1894,	18,432	3.49	-	-	-	-
New Braintree, . .	210	Aug. 6, 1895,	989	.18	-	-	-	-
Northborough, ¹ . .	122	Jan. 24, 1895,	3,834	.73	-	-	-	-
Northborough, ² . .	163	April 1, 1895,	11,000	2.08	-	-	-	-
Oakham, . . .	199	July 11, 1895,	15,045	2.85	-	-	-	-
Oxford, . . .	108	Dec. 24, 1894,	33,550	6.35	-	-	-	-
Paxton, . . .	33	July 10, 1894,	28,600	5.40	10,478	1.99	1,958	.37
Petersham, . . .	296	Oct. 22, 1896,	23,744	4.49	-	-	-	-
Phillipston, . . .	14	July 3, 1894,	17,400	3.30	-	-	-	-
Princeton, . . .	193	June 22, 1895,	14,221	2.69	-	-	-	-
Royalston, . . .	302	Dec. 7, 1896,	23,195	4.39	-	-	-	-
Rutland, ³ . . .	141	March 5, 1895,	24,581	4.65	-	-	-	-
Rutland, ⁴ . . .	142	March 5, 1895,	24,268	4.59	-	-	-	-
Shrewsbury, . . .	21	July 6, 1894,	11,000	2.08	5,291	1.00	3,926	.74
Southborough, . .	161	April 18, 1895,	5,300	1.00	-	-	-	-
Spencer, . . .	49	July 19, 1894,	23,418	4.44	-	-	-	-
Sterling, . . .	168	May 1, 1895,	5,280	1.00	-	-	-	-
Sturbridge, . . .	169	May 7, 1895,	12,600	2.39	-	-	-	-
Sutton, . . .	85	Aug. 25, 1894,	6,096	1.16	-	-	-	-
Templeton, . . .	86	Sept. 1, 1894,	31,668	6.00	-	-	-	-
Upton, . . .	305	Dec. 18, 1896,	24,743	4.69	-	-	-	-
Uxbridge, . . .	89	Sept. 28, 1894,	15,759	2.99	-	-	-	-
Warren, ⁵ . . .	15	July 5, 1894,	28,020	5.31	-	-	5,370	1.02
Warren, ⁶ . . .	39	July 16, 1894,	18,868	3.57	-	-	-	-
Westborough, ⁷ . .	160	April 14, 1895,	1,100	.20	-	-	-	-
Westborough, ⁸ . .	306	Dec. 30, 1896,	5,300	1.00	-	-	-	-
West Brookfield, .	222	Dec. 5, 1895,	800	.15	-	-	-	-
Westminster, . .	23	July 9, 1894,	30,590	5.79	6,495	1.24	2,455	.46
Worcester, . . .	162	April 22, 1895,	7,636	1.44	-	-	5,800	1.00
Totals, . . .	.	.	842,532	159.57	55,100	10.43	31,800	6.02

Fifty-two petitions (four city and forty-eight town). In two cities and forty-three towns.
Average distance petitioned for, 16,410 feet (3.11 miles).
Twenty-five lay-outs, in two cities and eight towns.
Length laid out, 86,900 feet (16.45 miles); average, 3,476 feet (.66 mile).
Laid out on city petitions, 10,433 feet (1.98 miles).
Laid out on town petitions, 76,467 feet (14.47 miles).
Percentage of length laid out to length petitioned for, 10.31.

¹ Westborough Hospital road.
² Holden road.
⁵ Worcester-Springfield road.
⁷ Hospital road.

³ Marlborough-Worcester road.
⁴ Paxton road.
⁶ Road to Brimfield and Wales.
⁸ Agricultural grounds road.

Statement showing Number of County, City and Town Petitions, Distribution of Petitions among Municipalities, and Number of Cities and Towns in which Lay-outs have been made, by Counties.

COUNTIES.	PETITIONS RECEIVED FROM —				PETITIONS SITUATED IN —			LAY-OUTS MADE IN —			Number of Lay- outs.
	Counties.	Cities.	Towns.	Total.	Cities.	Towns.	Total.	Cities.	Towns.	Total.	
Barnstable, . .	-	-	16	16	-	13	13	-	4	4	12
Berkshire, . .	11	3	19	33	2	20	22	2	5	7	17
Bristol, . . .	1	4	17	22	2	14	16	1	5	6	14
Dukes, . . .	1	-	4	5	-	5	5	-	3	3	6
Essex, . . .	1	9	15	25	5	16	21	4	3	7	10
Franklin, . .	1	-	19	20	-	14	14	-	4	4	10
Hampden, . .	4	1	11	16	2	14	16	-	5	5	15
Hampshire, . .	1	2	23	26	1	17	18	1	7	8	13
Middlesex, . .	5	4	30	39	3	29	32	-	6	6	12
Nantucket, . .	1	-	-	1	-	1	1	-	1	1	5
Norfolk, . . .	-	2	19	21	1	17	18	-	6	6	12
Plymouth, . .	-	2	26	28	1	23	24	-	10	10	25
Suffolk, . . .	-	1	2	3	1	2	3	-	-	-	-
Worcester, . .	-	4	48	52	2	43	45	2	8	10	25
Totals, . . .	26	32	249	307	20	228	248	10	67	77	176

Summary of Lengths petitioned for and laid out, by Counties, together with Percentage of Lengths laid out to Lengths petitioned for.

COUNTIES.	LENGTHS PETITIONED FOR		LENGTHS LAID OUT.						Per- cent- age.
			1894-95.		1896.		Total.		
	Feet.	Miles.	Feet.	Miles	Feet.	Miles.	Feet.	Miles.	
Barnstable, . .	292,315	55.36	44,340	8.40	18,534	3.51	62,874	11.91	21.51
Berkshire, . .	308,564	58.44	40,334	7.64	19,184	3.63	59,518	11.27	19.30
Bristol, . . .	456,114	86.38	46,075	8.73	14,101	2.67	60,176	11.40	13.19
Dukes,	112,716	21.35	26,042	4.93	9,890	1.87	35,932	6.80	31.85
Essex,	398,127	75.40	24,495	4.64	19,093	3.62	43,588	8.26	10.96
Franklin, . . .	195,483	37.01	30,469	5.77	4,855	.92	35,324	6.69	18.03
Hampden, . . .	371,457	70.35	34,378	6.51	14,949	2.83	49,327	9.34	13.28
Hampshire, . .	257,586	48.78	33,551	6.35	8,716	1.65	42,267	8.00	16.42
Middlesex, . .	573,267	108.57	29,762	5.63	19,814	3.76	49,576	9.39	8.65
Nantucket, . .	34,185	6.50	13,560	2.58	6,070	1.15	19,630	3.73	57.88
Norfolk, . . .	277,759	52.61	33,950	6.43	9,403	1.78	43,353	8.21	15.61
Plymouth, . .	592,863	112.28	58,400	11.06	19,072	3.61	77,472	14.67	13.06
Suffolk, . . .	35,575	6.73	-	-	-	-	-	-	-
Worcester, . .	842,532	159.57	55,100	10.43	31,800	6.02	86,900	16.45	10.31
Totals, . . .	4,748,493	899.33	470,456	89.10	195,481	37.02	665,937	126.12	14.13

Laid out on county petitions, 213,320 feet (40.40 miles).

Laid out on town petitions, 427,536 feet (80.97 miles).

Laid out on city petitions, 25,081 feet (4.75 miles).

Average length petitioned for, 15,467 feet (2.93 miles).

Average length laid out, 3,784 feet (.71 mile).

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PUBLIC DOCUMENT

. . . . No. 57.

SECOND ANNUAL REPORT

OF THE

METROPOLITAN WATER BOARD.

JANUARY 1, 1897.

BOSTON :

WRIGHT & POTTER PRINTING CO., STATE PRINTERS,

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METROPOLITAN WATER BOARD.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts in General Court assembled.

The Metropolitan Water Board respectfully submits its report for the year 1896, being its

SECOND ANNUAL REPORT.

The Metropolitan Water Board, established under chapter 488 of the Acts of the year 1895, began its work in July of that year. Its operations for the remainder of the year 1895 consisted chiefly in organizing its departments and entering upon the various surveys and investigations necessarily preliminary to the active work of construction which devolved upon the Board under the Act.

I. ORGANIZATION.

(1) *Administration.*

The Board, as originally appointed by the Governor, consisted of Henry H. Sprague of Boston, chairman, Wilmot R. Evans of Everett, and John R. Freeman of Winchester. Mr. Freeman, on account of removal from the Commonwealth, resigned his position, his resignation taking effect on April 15, 1896. Henry P. Walcott, M.D., of Cambridge, was appointed in his stead, and was qualified for his duties and began his service on the Board on April 16, 1896.

William N. Davenport of Marlborough has continued as secretary and executive officer of the Board and Alfred F. Bridgman as auditor and accountant. The office force has further comprised a book-keeper, an assistant in auditing, two stenographers, a messenger and a janitor.

(2) *Engineering Department.*

The engineering department is organized with the following principal engineers : —

Chief Engineer, FREDERIC P. STEARNS.

Consulting Engineers, JOSEPH P. DAVIS, ALPHONSE FTELEY.

Engineer of Distribution Department, DEXTER BRACKETT.

Engineer of Sudbury Department, DESMOND FITZGERALD.

Engineer of Dam and Aqueduct Department, THOMAS F. RICHARDSON.

Engineer of Reservoir Department, HIRAM A. MILLER.

Principal Office Assistant, REUBEN SHIRREFFS.

Subordinates in the engineering force have numbered 150, and, in addition, inspectors of pipe making, pipe laying, masonry and earth work, to the number of 30, have been employed. Laborers to assist in the making of borings and for handling of water pipes, repairing of roads and other minor operations have been employed from time to time, the maximum number at any one time being 97.

The contractors for building the tunnel and aqueduct, for excavation of the soil and the preparation for use of Reservoir No. 5, and for laying the main distribution pipes, have employed a large number of men, amounting in the busiest period of the year to 4,108 men, using 845 horses.

(3) *Legal Services.*

On entering upon its work the Board secured the legal services of Albert E. Pillsbury and Andrew J. Bailey of Boston, and Frank P. Goulding of Worcester, and these gentlemen were of great assistance to the Board in the organization of its work, the preparation of contracts, and establishing the basis of negotiations and settlements. On Nov. 1, 1896, under the provisions of chapter 490 of the Acts of the year 1896, the Attorney-General of the Commonwealth assumed the performance of the legal work of the Board, and since that date the duties of counsel have been performed under his direction.

(4) *Conveyancing Department.*

The necessity for the examination of all of the titles of the lands taken for the aqueduct in Berlin, Northborough, Marlborough and Southborough, and the titles of the lands which are to be taken for the reservoir in Clinton, Boylston, West Boylston and Sterling, has

required a large amount of conveyancing. This work has been done under the supervision of Alfred C. Vinton, who has been assisted in the work of the Boston office by George D. Bigelow, and at the Worcester registry by Charles T. Davis. For the examination of titles, preparation of papers and other matters connected with conveyancing, ten assistants, including two stenographers and a messenger, have been employed. The larger part of the preliminary work of the examination of titles in the Worcester registry, for the aqueduct line and the site of the great reservoir, has been completed, and the titles of eighty-seven estates have been finally passed upon. A large amount of other work, pertaining to titles in Southborough and Marlborough and the various other sections of the Metropolitan Water District, has been accomplished.

(5) *Police.*

The Board being required to furnish, without charge, to all towns within which any work is done under the authority of the Act, such additional police protection as may be necessary in consequence of its work, has provided for the appointment of officers as follows:—

<i>Reservoir No. 5.</i>		
Southborough,	. . . . .	14 officers.
Marlborough,	. . . . .	8 “
<i>Nashua Reservoir and Aqueduct.</i>		
Clinton,	. . . . .	3 officers.
Berlin,	. . . . .	9 “
Northborough,	. . . . .	6 “
Boylston and West Boylston,	. . . . .	1 “
Total number,		41 “

The officers in Southborough are appointed, in accordance with an agreement made by the town with the city of Boston, by the selectmen of Southborough; and the officers in Marlborough are appointed by the mayor of that city, subject to the confirmation of this Board, and are under his supervision.

The officers in the towns of Clinton, Berlin and Northborough are appointed by the selectmen of the respective towns, with the consent of the Board. The force in the towns of Berlin and Northborough is under the direction of Isaac M. Drew as chief.

In addition, it was deemed desirable to have one officer for the towns of Boylston and West Boylston, although the work of construction has not been begun in these towns. For the purpose, Frank H. Baldwin, who is also a deputy sheriff for the county of Worcester, was designated, and he adds to his duties a general care of the property of the Board in these towns.

In comparison with the number of men employed under the various contracts in the districts where the work of construction is carried on, little disorder has arisen, and the officers have attempted to guard, as far as possible, the interests of the people of the districts.

(6) Offices and Buildings.

The office of the Board for administration purposes, the central and drafting offices of the engineering department, and the conveyancers' office have continued at No. 3 Mt. Vernon Street in Boston. A room in Worcester, in convenient connection with the registry of deeds, has been required for the use of the title examiners in Worcester County.

Branch offices of the engineering department have been maintained in Clinton, West Boylston, Northborough, Marlborough and Southborough.

The necessity for large accommodations, not only adequate for the performance of the work which is to be carried on in and about Clinton for several years to come, but also sufficiently fireproof to insure the safety of the various plans and surveys necessary to be kept in the vicinity of the dam and reservoir, required the erection of a new building at Clinton, as none adapted to the requirements of the Board could be found in that town. The Board accordingly purchased a lot at the corner of Walnut and Prospect streets, and is erecting a building which it is expected will be completed in a short time.

The headquarters of the police for the district of the Nashua Aqueduct have been maintained at West Berlin, in a building which has been leased for the purpose. The police headquarters at Fayville in Southborough, established by the city of Boston for the Reservoir No. 5 district, have been continued there in a building belonging to the Commonwealth.

The large amount of pipe required for the distribution lines has necessitated the establishment of three pipe yards for receiving and

storing the pipes before they are conveyed to the various points where they are laid. These pipe yards are (1) on the line of the Boston & Maine Railroad at Edgeworth in Malden, and (2) at Park Street in Somerville, and (3) at the end of Windsor Street on the boundary between Somerville and Cambridge on the line of the Fitchburg Railroad.

Temporary field offices have been erected at other places, as the exigencies of the work have demanded.

II. DUTIES IMPOSED UPON THE BOARD.

The Act of the year 1895 required the Board to construct, maintain and operate a system of water works in accordance with plans and recommendations submitted by the State Board of Health in that year, and to provide thereby a sufficient supply of pure water for the cities of Boston, Chelsea, Everett, Malden, Medford, Newton and Somerville, and the towns of Belmont, Hyde Park, Melrose, Revere, Watertown and Winthrop. Provision was also made for the admission into the Metropolitan Water District of other cities and towns any parts of which are within ten miles of the State House, for supplying water to water companies owning pipe and water systems in towns within said ten miles, and also for permitting the Board to furnish water to other cities and towns and water companies.

The principal features of the work required to be performed by the Board are the following:—

First. — The erection of a large dam and dikes at Clinton, and the construction upon the south branch of the Nashua River, in the towns of Clinton, Boylston, West Boylston and Sterling, of a storage reservoir having a capacity of about 63,000,000,000 gallons of water, and covering an area, exclusive of margins, of about 6½ square miles.

Second. — The building of an aqueduct capable of conveying daily 300,000,000 gallons of water, from the dam at Clinton, a distance of 12 miles, through the towns of Clinton, Berlin, Northborough, the city of Marlborough and the town of Southborough, to the new reservoir of the Sudbury water system in the town of Southborough and the city of Marlborough, known as Reservoir No. 5. This aqueduct embraces (1) a tunnel, through rock, 2 miles long; (2) a covered masonry aqueduct, 7 miles long, with a stone bridge cross-

ing the Assabet River; (3) an open channel, 3 miles long, substantially following the course of Stony Brook into the Reservoir No. 5.

Third. — The taking of the lands in and around Reservoir No. 5 in Southborough and Marlborough, and completing the construction of the reservoir which had been begun and nearly half finished by the city of Boston, — a reservoir which, when completed, is to cover an area of about 2 square miles, and to have a capacity of about 7,500,000,000 gallons of water.

Fourth. — The taking, on or before the first day of January in the year 1898, of all the lands and water works held by the city of Boston for the purpose of storing, preserving and supplying water, westward of the Chestnut Hill Reservoir in Boston, and westward of the pipes to be laid from the Chestnut Hill Reservoir to Spot Pond, including the pumping station at the Chestnut Hill Reservoir, and the lands under and surrounding the same.

Fifth. — The taking, on or before the first day of January in the year 1898, of Spot Pond, in the town of Stoneham and the city of Medford, and the lands under and surrounding the same, with the pumping stations thereon.

Sixth. — The building of new pumping stations at the Chestnut Hill Reservoir and in other parts of the Metropolitan Water District, as may be required.

Seventh. — The laying of great main distributing pipes from the Chestnut Hill Reservoir, to connect with Spot Pond and the various cities and towns constituting the Metropolitan Water District, for the distribution of the water to the various municipalities.

By the construction of these works it is proposed that the water of the Nashua water-shed, having an area of about 118 square miles, and capable of yielding, even in a series of very dry years, 105,000,000 gallons of water daily; shall be stored in the great reservoir on the south branch of the Nashua River; that the water shall be conveyed by the Nashua Aqueduct to the new Reservoir No. 5 in Southborough and Marlborough; and thence conveyed, with the mingled waters of the present Sudbury and Cochituate systems of the city of Boston, to the Chestnut Hill Reservoir and to Spot Pond, from which it shall be distributed to the various cities and towns of the Metropolitan Water District. The completion of this system would seem to insure to the District, in the most unfavorable seasons, a daily supply of at least 173,000,000 gallons of



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water, — a supply double that obtainable from all the sources combined now utilized for the cities and towns composing the Metropolitan Water District.

The accompanying plan, being Plan No. 1, shows the location of the projected Nashua Reservoir in Clinton, Boylston, West Boylston and Sterling, and the Nashua water-shed; the three sections of the Nashua Aqueduct in process of construction leading from the Nashua Reservoir to the Reservoir No. 5 in Southborough and Marlborough; Reservoir No. 5 and the completed basins of the Sudbury system, with the Sudbury water-shed; the Lake Cochituate and the Cochituate water-shed; the present Sudbury and Cochituate aqueducts, leading to the Chestnut Hill Reservoir; and the main pipe lines in process of construction from the Chestnut Hill Reservoir to Spot Pond.

III. WORK OF CONSTRUCTION.

The first duty of the Board seemed to be to furnish an increased supply of water at the earliest possible period to the city of Boston and several others of the cities and towns constituting the Metropolitan Water District, in which the demand for water has nearly, if not quite, reached the supply of a year of moderate rainfall, and in which the supply of a dry year would be entirely inadequate to meet the demands. For this purpose the building of the Nashua Aqueduct, to connect the water of the Nashua River with the Sudbury system of Boston, the completion of the Reservoir No. 5, and the laying of the distributing main water pipes to connect the Chestnut Hill Reservoir with Spot Pond and the various cities and towns of the Metropolitan Water District, were pushed forward with all possible speed, and satisfactory progress has, on the whole, been made in these operations.

(1) *Nashua Aqueduct.*

The work of construction of the Nashua Aqueduct was begun early in the year 1896. The contracts for the building of the two miles of tunnel were awarded in February last. In May contracts were made for the seven miles of covered masonry aqueduct, in June for the construction of the bridge over the Assabet River, and in September for the construction of the open channel at the end of the Aqueduct.

The estimates for the construction of the Nashua Aqueduct, which formed the basis for awarding the contracts, independent of engineering and incidental charges, were as follows : —

Two miles of tunnel,	\$370,826 00
Seven miles of covered masonry aqueduct,	721,580 60
Bridge over the Assabet River,	64,676 25
Three miles of open channel,	89,470 00
Making a total of	<u>\$1,246,552 85</u>

The amount paid by the Commonwealth to Dec. 1, 1896, on account of contracts, was \$204,522.61; for land damages, \$12,337.50; and for engineering and other expenses, \$81,834.36, — a total of payments amounting to \$298,694.47.

For the construction of the Nashua Aqueduct, 94 lots of land, belonging to 66 different owners, were taken, having a total area of 261.64 acres. Settlements have already been made with 16 of the owners.

The two miles of tunnel and the stone bridge over the Assabet River are both already more than half completed; and such progress has been made upon the various sections of the covered masonry aqueduct and the open channel as to lead to the assurance that the whole Aqueduct will be completed by the end of the year 1897, or early in the succeeding year, so that the water flowing in the south branch of the Nashua River may be diverted and conveyed through the Aqueduct to Reservoir No. 5.

The accompanying plan, being Plan No. 2, shows the three sections of the aqueduct and a profile of the elevation of the Aqueduct, and indicates the progress which has been attained.

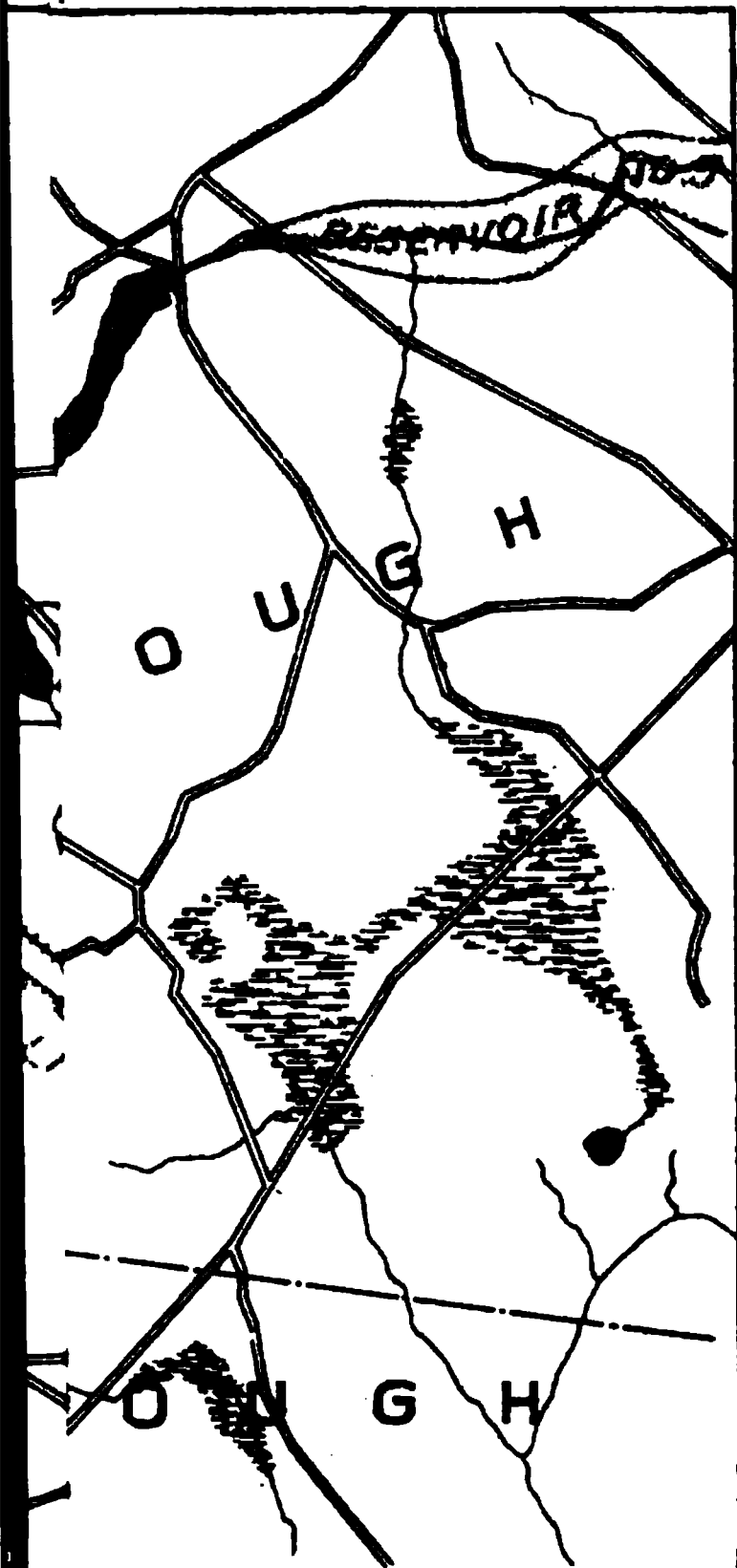
The accompanying Plan No. 3 gives sections of the Aqueduct, showing the different methods of construction on embankment and in excavation, and in rock and in earth. This plan also gives an elevation of the stone bridge across the Assabet River, with longitudinal and cross-sections, and indicates the progress of the work.

Tables giving the names of the various contractors, the estimated amount and estimated value of the work to be done under the contracts, and other details, will be found in the Appendix.

(2) *Reservoir No. 5.*

The lands in and immediately surrounding Reservoir No. 5, in the town of Southborough and the city of Marlborough, were taken

PLAN No. 2.



COMMONWEALTH OF MASSACHUSETTS

STATE WATER BOARD

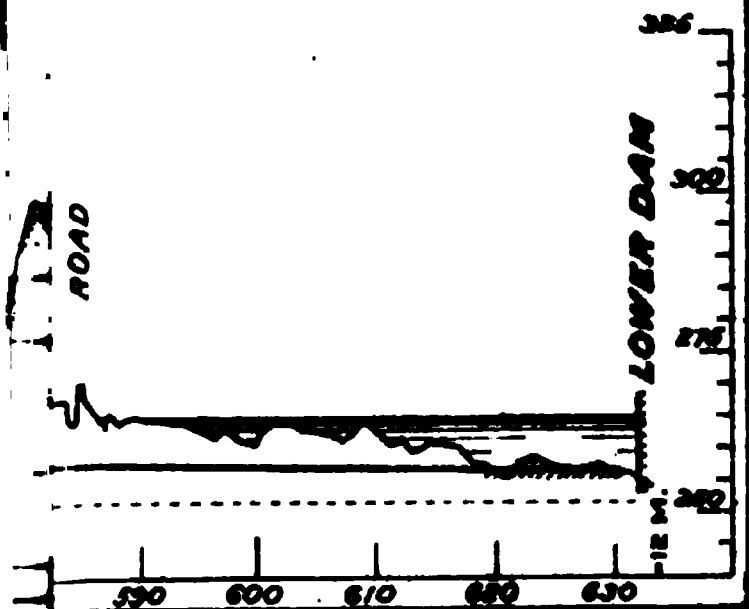
A AQUEDUCT

FILE SHOWING PROGRESS

TO

January 1st 1896

Excavation and Embankment... thus...
"....."



Geo. H. Walker & Co., Lith., Boston.

PLAN No.3.

TUNNEL LINED

AQUEDUCT IN ROCK

CROSS SECTION

by the Board in behalf of the Commonwealth on Jan. 4, 1896, and the contracts for construction which had been made by the city of Boston and were in process of execution were assumed by the Board. The contracts made by the city of Boston provided for the building of the dam and the stripping and preparation of about one-half of the territory to be submerged in the reservoir.

The Metropolitan Water Act required that the city of Boston should be reimbursed for all moneys paid for land damages, or otherwise, in connection with the building of this reservoir, and for the lands taken for the protection of the purity of the water. The Board has accordingly examined and audited the accounts for the expenditures made by the city of Boston in the taking and purchase of lands and in the construction of the dam and reservoir, and has caused the city to be reimbursed by the payment of \$1,118,-975.74.* There are, in addition, some claims still unsettled on account of the lands which have been taken and the other operations of the city.

Contracts for the completion of the stripping and filling of the reservoir, to prepare it for the introduction of water, were made in April last, and work was immediately begun under them by the various contractors. The dam is nearly finished, and several of the contracts for the preparation of the reservoir, which were made by the city of Boston, have already been completed.

Inasmuch as the location of the New York, New Haven & Hartford Railroad runs through the reservoir, it was necessary, in order to connect the separated portions, to construct a new stone arch bridge near Fayville in Southborough, and somewhat to widen the embankment of the road bed and to riprap the slopes. This work was undertaken and vigorously prosecuted to completion at a total cost of \$33,400.21.

Considerable work has been required to complete the new highways, whose construction the city of Boston had undertaken, in order to supply the place of the several miles of roads in Southborough and Marlborough, within the limits of the reservoir, which had been discontinued.

Such progress has been made in the performance of the various contracts still pending that it is believed that the completion of the dam and reservoir early in the year 1898 is assured.

* The final payment of \$518,975.74 was made to the city of Boston in December, 1896.

Estimates of the sums which will be required to be paid under the various contracts for building the dam and constructing the reservoir, based upon the work already performed and that which is still to be done, amount to a total sum of \$1,852,624.25. The sum paid by the city of Boston on account of the taking and purchase of lands for the reservoir and of other land damages, together with the estimated sum due on account of unsettled land claims, and including engineering and incidental expenses, amounts to about \$800,000, so that it is estimated that the total cost of Reservoir No. 5 will somewhat exceed \$2,600,000. In addition to the \$1,118,975.74 paid in reimbursement to the city of Boston, the payments by the Commonwealth on account of Reservoir No. 5 up to Dec. 1, 1896, have amounted to \$747,025.20, and the total of the payments made has been \$1,347,025.20.

The various sections of the reservoir and the progress made toward the completion of the work, with diagrams showing the method of construction of the dam and the system adopted for the preparation of the reservoir for the introduction of water, are represented on the accompanying plan, being Plan No. 4.

Tables showing the names of the various contractors, the estimated amount and value of the work to be done, and the amount completed in December, 1896, will be found in the Appendix.

As the lower portions of the reservoir are prepared to receive the water, the work of filling the reservoir will soon be begun, and it is believed that sufficient water will be collected the present season so that, in case the necessity therefor shall arise in the coming summer, a substantial addition may be afforded to the existing supply of the city of Boston.

(3) Main Distributing Pipe Lines.

Two main lines of 48-inch cast-iron pipes are projected to be laid from the Chestnut Hill Reservoir to Spot Pond, which is to be used as a storage and distributing reservoir for the city of Boston and other lower portions of the Metropolitan Water District. Pipes 48 inches in diameter and pipes of lesser dimensions are also to be laid to connect with the various cities and towns in the Metropolitan District.

The first contract for the manufacture of the pipes was made on Dec. 27, 1895, and subsequent contracts have from time to time



been made for furnishing additional pipes, to an amount in all of 42,920 tons. More than two-thirds of the pipes estimated as necessary have already been contracted for, and a large portion of this amount has been delivered.

The work of laying the pipes was begun in May last. Contracts have been made for laying nearly the whole length of one of the main lines from Chestnut Hill Reservoir to Spot Pond, extending through Brookline, Brighton, Cambridge, Somerville, Medford, Malden, Melrose and Stoneham. Permission to cross the Charles and Mystic rivers was given by the Board of Harbor and Land Commissioners of the Commonwealth, and was also, on recommendation of Col. S. M. Mansfield, U. S. A., accorded by the Secretary of War. The larger part of this line has already been completed. Contracts have also been made for laying branch pipe lines in Medford and Malden, and in Everett, Chelsea and Revere, and a considerable portion of the work under these contracts has been finished. A portion of the second main line to Spot Pond has also been laid. The pipes already laid extend a distance of about 15 miles.

The contracts for furnishing pipes, according to estimates based upon those already furnished and the approximate value of those still to be furnished, amount to \$869,424.86. The approximate amount of contracts made for the laying of pipes, under a similar estimate, is \$166,836.33. Miscellaneous contracts in connection with pipe lines amount to \$18,279.59. The total amount of contracts for the distributing system is \$1,054,540.78. Payments made on contracts for pipes and valves up to Dec. 1, 1896, amount to \$535,109.40, and on contracts for pipe laying amount to \$116,881.83.

There is little doubt but that at the end of the year 1897 the Chestnut Hill Reservoir and Spot Pond will be connected by one of the main lines, and connections will be made from the Chestnut Hill Reservoir or Spot Pond with the most of the cities and towns in the Metropolitan Water District.

The accompanying plan, being Plan No. 5, shows the location of the various pipe lines, the different dimensions of the pipes, the portions contracted for, both laid and not laid, and other lines projected, with the character of the service and other details.

There will be found in the Appendix the details of the various contracts made for furnishing and for laying the pipes and valves and for the miscellaneous work.

(4) *Nashua Dam and Reservoir.*

No taking has as yet been made of the waters of the south branch of the Nashua River, nor have any of the lands to be included in the Nashua Reservoir been taken under the Act authorizing the taking of the waters and lands.

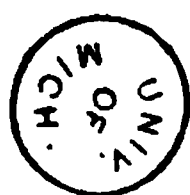
The surveys and investigations necessarily preliminary to the construction of the dam in Clinton and the Nashua Reservoir have been pushed forward as fast as possible; but they have not reached such a degree of completion as to permit the making of definite plans and specifications; and consequently the time has not yet been reached when a satisfactory taking of the waters and lands can be made.

Negotiations, however, have not only been carried on for the settlement of the damages to the various mill properties in the basin of the Reservoir, but also the claims for damages for water to be diverted have been considered, and in some cases settlements have been effected. Inasmuch, also, as it has not seemed proper for the Board yet to make the taking, under the right of eminent domain contemplated by the Act, it has been the policy of the Board to enter into negotiations with all parties who desire to meet it, and who desire for any reasons to surrender their properties before the takings are made. It is believed that in this way not only the requirements of the Board will be better satisfied, but also that the convenience and best interests of the parties who are to suffer from the loss of their estates will be better subserved than by a summary taking and divesting of ownership or occupation.

Settlements have been effected with the West Boylston Manufacturing Company and the Clarendon Mills of West Boylston, and the properties of both these corporations have been conveyed to the Commonwealth. The corporations are permitted, however, under the agreement made, to occupy their estates for a considerable period, or until they shall be needed for the purposes of the work. The number of acres conveyed to the Commonwealth by these corporations was 260.

A settlement has also been effected with the Locks and Canals Company of Lowell and the Essex Company of Lawrence for the damages which will be occasioned by the diversion of the water of the Nashua River.

Purchases have been made from 54 private parties of estates in Boylston, West Boylston, Clinton and Sterling, situated within the



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proposed limits of the Reservoir. These purchases include both village property and farms, and also the Catholic churches in West Boylston and Boylston, and comprise an area of about 950 acres.

The amount paid to Dec. 1, 1896, for lands, buildings and water rights in connection with the reservoir has been \$863,164, and the conveyances embrace an area of 1,210 acres. An additional amount of \$203,000 was paid on account of damages for the diversion of water.

Borings and other investigations have been constantly in progress, in order to ascertain the best location for the main dam and also for the north and south dikes. Good progress has been made in both directions, and it is believed that the work preliminary to the construction of the dam can be entered upon during the coming season, and that plans and specifications can also be made and contracts for construction awarded.

Considerable progress has also been made in the surveys for the relocation of the various roads in the towns in which the Reservoir is to be constructed. Plans have already been nearly completed for the laying out of the new road to take the place of the river road, so called, running from Clinton through Boylston Centre to Worcester, and its route will probably be definitely determined and its construction begun early in the year 1897.

Surveys have been made for the relocation of the Central Massachusetts division of the Boston & Maine Railroad, but no definite action has been taken. No disturbance will be made for a considerable period of time of the present location of the railroad.

(5) *Spot Pond and Vicinity.*

Many surveys and investigations have been made of the territory surrounding Spot Pond in order to ascertain what work shall be necessary in order to adapt it to the purposes of a storage and distributing reservoir, and investigations have also been carried on and plans have been completed for the purpose of determining the most feasible routes for the water pipes through the Middlesex Fells, now embraced within the limits of the metropolitan park system. Borings and other examinations have been carried on in the Fells for definitely determining the best location of the high-service reservoir, which was contemplated to be built in the Fells. The various investigations will be continued and will probably all be finished in the coming year.

(6) *Pumping Station at Chestnut Hill.*

The necessity of providing at an early date for a pumping engine for the high service, to be used in connection with the present pumping engine at the Chestnut Hill station, in Boston, has caused the Board, after careful and thorough investigations, to arrange for a contract with the Edward P. Allis Company of Milwaukee, Wis., for the building of a pumping engine having a capacity to lift 30,000,000 gallons of water per day. It is the intention of the Board that the engine shall be completed and placed in position by the middle of the year 1898.

IV. THE ADMISSION OF OTHER MUNICIPALITIES INTO THE METROPOLITAN WATER DISTRICT.

In accordance with the application made by the city of Quincy, investigations have been made as to the proper method of furnishing that city with a sufficient supply of water. It was found desirable, instead of erecting a large tank on Forbes Hill in that city, to erect a small standpipe and reservoir in that location, which should be sufficient to provide for a storage of water sufficient to meet the demands of any emergency which might occur.

Negotiations with that end in view have accordingly been in progress with the mayor and city council of that city, and arrangements have been effected by which it is anticipated that the city of Quincy will be admitted into the Metropolitan Water District at an early date.

Conferences have been had with representatives of several of the other municipalities lying within ten miles of the State House, and not now included in the Metropolitan Water District, and in one or two instances with representatives from towns situated more remote from the State House, in relation to their admission into the district or to their obtaining a supply of water from the new system, but no definite action has as yet been taken by any of these municipalities.

V. FINANCIAL STATEMENT.

The Board presents in abstract, as required by the act of the Legislature, the following accounts of its expenditures and disbursements, receipts, assets and liabilities.

(1) Expenditures.

The total amount of expenditures for the year ending Nov. 30, 1896, is \$3,563,818.58, and the total amount from the time of the organization of the Board, July 19, 1895, is \$3,613,310.33. The general character of these expenditures is as follows: —

	For the Year ending Nov. 30, 1896.	From the Beginning of the Work to Dec. 1, 1896.
<i>Administration.</i>		
Commissioners,	\$15,166 67	\$19,533 60
Secretary and auditor,	6,175 00	7,615 33
Clerks and stenographers,	4,309 95	5,119 02
Legal services,	2,334 00	2,334 00
Travelling,	132 68	163 59
Stationery and printing,	1,358 76	1,768 60
Postage, express and telegrams,	255 35	287 25
Furniture and fixtures,	359 60	2,504 14
Alterations and repairs of building,	75 09	1,506 31
Telephone, lighting, heating, water and care of building,	808 50	1,138 18
Miscellaneous expenses,	480 40	742 11
	<hr/> \$31,456 00	<hr/> \$42,712 13
<i>Engineering.</i>		
Chief engineer and department en- gineers,	\$19,483 28	\$24,219 84
Principal assistant engineers,	14,627 85	15,216 56
Engineering assistants,	89,852 44	101,928 46
Consulting engineers,	5,361 10	5,361 10
Inspectors,	19,340 96	19,340 96
Railroad and street-car travel,	3,238 38	4,126 44
Wagon hire,	2,155 11	2,492 96
Stationery and printing,	4,083 13	4,433 28
Postage, express and telegrams,	896 72	994 23
Engineering and drafting instru- ments and tools,	5,649 83	9,851 48
Engineering and drafting supplies,	4,859 69	5,929 48
Books, maps and photographic sup- plies,	864 14	1,199 81
Furniture and fixtures,	3,586 68	7,763 58
Alterations and repairs of building, — main office,	208 94	2,154 94
Alterations and repairs of building, — sub-offices,	16 06	16 06
Telephone, lighting, heating, water and care of building, — main office,	1,349 57	1,372 45
Telephone, lighting, heating, water and care of building, — sub-offices,	1,605 11	1,637 46
Rent of offices and other buildings,	1,076 78	1,205 43
<i>Amounts carried forward,</i>	<hr/> \$178,255 77	<hr/> \$209,244 52
	\$31,456 00	\$42,712 13

	For the Year ending Nov. 30, 1896.		From the Beginning of the Work to Dec. 1, 1896.	
<i>Amounts brought forward,</i>	\$178,255 77	\$31,456 00	\$209,244 52	\$42,712 13
<i>Engineering — Con.</i>				
Field offices and sheds, . . .	449 77		449 77	
Clinton office building, . . .	3,636 02		3,636 02	
Unclassified supplies, . . .	2,651 29		3,296 31	
Miscellaneous expenses, . . .	1,763 68		2,307 39	
		186,756 53		218,934 01
<i>Construction.</i>				
Preliminary work (borings, soundings, test pits and other investigations) : —				
Advertising,	\$1,419 26		\$1,419 26	
Labor,	20,669 28		23,779 91	
Medical service, analyses, etc., .	410 83		433 83	
Travelling,	643 97		710 72	
Rent,	23 00		28 00	
Water rates,	772 77		897 81	
Freight and express,	187 78		239 36	
Jobbing and repairing,	252 29		316 29	
Tools, machinery, appliances and hardware supplies, . . .	10,808 15		12,200 20	
Castings and iron work, . . .	34 85		70 87	
Iron pipe and valves,	1,439 00		1,896 85	
Blasting supplies,	23 35		31 60	
Paint and coating,	117 81		123 81	
Fuel, oil and waste,	263 84		263 84	
Lumber and field buildings, . .	3,289 54		3,634 55	
Brick, cement and stone, . . .	17 59		53 59	
Sand, gravel and filling, . . .	157 55		157 55	
Unclassified supplies,	366 86		697 82	
Miscellaneous expenses,	41 30		41 30	
		40,939 02		46,897 16
Contracts, Nashua Aqueduct : —				
E. D. Smith & Co., Section 2,	\$24,525 00		\$24,525 00	
E. D. Smith & Co., Section 3,	38,389 50		38,389 50	
Silvio Casparis, . Section 4,	9,803 12		9,803 12	
Silvio Casparis, . Section 5,	10,279 08		10,279 08	
Silvio Casparis, . Section 6,	8,747 73		8,747 73	
Silvio Casparis, . Section 7,	15,709 77		15,709 77	
Jones, Pollard & Co., Section 8,	17,676 98		17,676 98	
Silvio Casparis, . Section 9,	14,712 91		14,712 91	
Silvio Casparis, . Section 10,	63,699 32		63,699 32	
Moulton & O'Mahoney, Section 11,	979 20		979 20	
		204,522 61		204,522 61
Contracts, Sudbury department : —				
Moulton & O'Mahoney, Dam No. 5,	\$211,329 60		\$211,329 60	
Auguste Saucier, . Section A,	681 99		681 99	
Moulton & O'Mahoney, Section B,	40,304 58		40,304 58	
<i>Amounts carried forward,</i>	\$252,316 17	\$463,674 16	\$252,316 17	\$513,065 91

	For the Year ending Nov. 30, 1896.		From the Beginning of the Work to Dec. 1, 1896.	
<i>Amounts brought forward,</i> .	\$252,316 17	\$463,674 16	\$252,316 17	\$513,065 91
<i>Construction — Con.</i>				
Contracts, Sudbury departm't — <i>Con.</i>				
Malone & Strang, . Section C,	50,616 25		50,616 25	
Auguste Saucier, . Section D,	28,499 82		28,499 82	
Charles Linehan, . Section E,	23,123 90		23,123 90	
Newell & Snowling, Section F,	18,093 37		18,093 37	
Charles Linehan, . Section G,	11,009 56		11,009 56	
Moulton & O'Mahoney, Section H,	24,977 42		24,977 42	
Harry P. Nawn, . Section I,	36,561 68		36,561 68	
Moulton & O'Mahoney, Section J,	29,764 62		29,764 62	
Blagen & Bush, . Section K,	21,901 18		21,901 18	
Moulton & O'Mahoney, Section L,	22,701 12		22,701 12	
Harry P. Nawn, . Section M,	20,538 38		20,538 38	
Thos. Nevins & Son, Section N,	37,249 38		37,249 38	
Washburn & Washburn, Section O,	19,136 78		19,136 78	
Harry P. Nawn, . Section P,	26,820 75		26,820 75	
Washburn & Washburn, Section Q,	30,264 54		30,264 54	
Henry Parsons, . Iron fence,	5,142 54		5,142 54	
John Berry, . . . Filter beds,	896 79		896 79	
Holbrook, Cabot & Daly, Stone arch bridge,	20,549 43		20,549 43	
New York, New Haven & Hart- ford Railroad Company, Tem- porary bridge,	3,731 06		3,731 06	
		683,894 74		683,894 74
Contracts, distribution department:—				
Curnan & Hochstadter, Section 2,	\$39,517 92		\$39,517 92	
Snyder & Williams, Sections 4 and 11,	24,600 84		24,600 84	
D. F. O'Connell, . Section 6,	13,744 70		13,744 70	
C. H. Eglee Company, Sections 7 and 13,	21,330 83		21,330 83	
Collins & Ham, . Section 14,	2,513 53		2,513 53	
J. H. McKnight, . Section 15,	10,538 43		10,538 43	
George Goodhue, . Section 16,	2,516 87		2,516 87	
Collins & Ham, . Section 18,	2,118 71		2,118 71	
R. D. Wood & Co., Iron pipes,	207,419 30		207,419 30	
McNeal Pipe and Foundry Com- pany, . . . Iron pipes,	153,990 07		153,990 07	
Warren Foundry and Machine Company, . . . Iron pipes,	107,829 91		107,829 91	
Howard Harrison Iron Company, Iron pipes,	63,593 82		63,593 82	
Josiah H. Long, . . . Valves,	2,276 30		2,276 30	
New Jersey Steel and Iron Com- pany, . . . Steel work,	1,041 00		1,041 00	
Chelmsford Foundry Company, Castings,	733 59		733 59	
		653,765 82		653,765 82
<i>Amounts carried forward,</i> .	.	\$1,601,334 72		\$1,850,726 47

	For the Year ending Nov. 30, 1896.	From the Beginning of the Work to Dec. 1, 1896.
<i>Amounts brought forward,</i>	<i>\$1,801,334 72</i>	<i>\$1,850,726 47</i>
<i>Construction — Con.</i>		
Additional work : —		
Labor,	\$10,035 38	\$10,035 38
Medical service,	6 00	6 00
Travelling,	140 14	140 14
Rent,	300 00	300 00
Water rates,	4 50	4 50
Freight and express,	239 80	239 80
Jobbing and repairing,	294 38	294 38
Tools, machinery, appliances and hardware supplies,	1,524 97	1,524 97
Castings and iron work,	502 99	502 99
Iron pipe and valves,	1,277 19	1,277 19
Paint and coating,	1,057 89	1,057 89
Fuel, oil and waste,	12 63	12 63
Lumber and field buildings,	1,561 40	1,561 40
Drain pipe,	73 69	73 69
Brick, cement and stone,	227 80	227 80
Sand, gravel and filling,	363 90	363 90
Municipal and corporation work,	2,249 80	2,249 80
Police service,	19,950 36	19,950 36
Sanitary inspection,	1,577 75	1,577 75
Unclassified supplies,	89 05	89 05
Miscellaneous expenses,	64 61	64 61
	<u>41,554 23</u>	<u>41,554 23</u>
Legal and expert services,	3,277 32	3,277 32
<i>Real Estate.</i>		
Legal and expert : —		
Counsel and assistants,	\$4,295 31	\$4,295 31
Conveyancer and assistants,	14,185 19	14,185 19
Experts,	4,875 12	4,875 12
Appraisers,	464 78	464 78
Conveyancing supplies,	1,024 47	1,024 47
Conveyancing expenses,	424 32	424 32
Miscellaneous expenses,	60 95	60 95
Settlements,	877,988 00	877,988 00
Taxes and tax equivalents,	1,626 02	1,626 02
Care and disposal,	313 58	313 58
	<u>905,257 74</u>	<u>905,257 74</u>
<i>Damages.</i>		
Legal services,	1,130 67	1,130 67
<i>Claims on Account of Diversion of Water.</i>		
Legal services,	\$3,749 98	\$3,749 98
Expert services,	2,970 41	3,070 41
Settlements,	203,000 00	203,000 00
	<u>209,720 39</u>	<u>209,820 39</u>
<i>Amounts carried forward,</i>	<i>\$2,962,275 07</i>	<i>\$3,011,766 82</i>

	For the Year ending Nov. 30, 1896.	From the Beginning of the Work to Dec. 1, 1896.
<i>Amounts brought forward,</i>	<i>. . . \$2,962,275 07</i>	<i>\$3,011,766 82</i>
<i>Purchase of Water Works.</i>		
Legal and expert:—		
Legal services,	\$1,538 51	\$1,538 51
Miscellaneous expenses, . .	5 00	5 00
Reimbursement, city of Boston (for Reservoir No. 5),*	600,000 00	600,000 00
	<u>601,543 51</u>	<u>601,543 51</u>
Total,	<i>. . . \$3,563,818 58</i>	<i>\$3,613,310 33</i>

The expenditures have been distributed among the various objects or works as follows:—

	For the Year ending Nov. 30, 1896.	From the Beginning of the Work to Dec. 1, 1896.
General administration, applicable to all parts of the work, . . .	<i>. . . \$31,456 00</i>	<i>\$42,712 13</i>
<i>Nashua Dam and Reservoir.</i>		
Main dam, engineering, . . .	\$9,512 67	\$12,191 35
preliminary work, . . .	17,490 88	22,248 51
North dike, engineering, . . .	2,539 31	2,759 31
preliminary work, . . .	6,727 91	6,727 91
South dike, engineering, . . .	395 67	480 67
preliminary work, . . .	2,370 68	2,370 68
Removal of soil, engineering, . .	4,794 44	6,175 94
preliminary work, . . .	879 15	879 15
Relocation of railroads, engineering,	1,001 11	1,387 61
Roads and bridges, engineering, .	2,285 64	2,465 64
Real estate:—		
Engineering,	19,705 35	22,166 76
Legal and expert,	16,286 10	16,286 10
Mill property and water rights, .	765,000 00	765,000 00
Other property for reservoir and margin:—		
Clinton,	17,350 00	17,350 00
Boylston,	19,905 00	19,905 00
West Boylston,	55,325 00	55,325 00
Sterling,	675 00	675 00
Outlying property:—		
Clinton,	3,609 00	3,609 00
Boylston,	370 00	370 00
West Boylston,	930 00	930 00
<i>Amounts carried forward,</i>	<i>\$947,152 91 \$31,456 00</i>	<i>\$959,303 63 \$42,712 13</i>

* The additional sum of \$518,975 74 was paid to the city of Boston in December, 1896.

	For the Year ending Nov. 30, 1896.		From the Beginning of the Work to Dec. 1, 1896.	
<i>Amounts brought forward,</i> .	\$947,152 91	\$31,456 00	\$959,303 63	\$42,712 13
<i>Nashua Dam and Reservoir — Con.</i>				
Real estate — <i>Con.</i>				
Taxes, care and disposal, . . .	166 72		166 72	
Legal and expert (except in real estate),	1,130 67		1,130 67	
		948,450 30		960,601 02
<i>Nashua Aqueduct.</i>				
Engineering,	\$50,930 25		\$60,990 18	
Legal and expert,	8,311 65		8,311 65	
Preliminary work,	2,256 50		3,426 01	
Contracts : —				
Masonry in tunnel,	56,450 04		56,450 04	
Masonry in trench,	129,416 39		129,416 39	
Assabet bridge,	17,676 98		17,676 98	
Open channel,	979 20		979 20	
Additional work,	8,903 77		8,903 77	
Real estate : —				
Property in Berlin,	5,125 00		5,125 00	
Property in Clinton,	5,600 00		5,600 00	
Property in Northborough,	362 50		362 50	
Property in Marlborough,	550 00		550 00	
Property in Southborough,	700 00		700 00	
Care and disposal,	202 75		202 75	
		287,465 03		298,694 47
<i>Dam and Reservoir No. 5.</i>				
Dam : —				
Engineering,	\$9,019 39		\$9,019 39	
Preliminary work,	464 22		464 22	
Contracts,	211,329 60		211,329 60	
Additional work,	2,677 82		2,677 82	
Reservoir : —				
Engineering,	29,836 92		29,836 92	
Preliminary work,	333 12		333 12	
Contracts,	471,668 35		471,668 35	
Additional work,	16,548 84		16,548 84	
Protection and improvement of sup- ply : —				
Engineering,	851 63		851 63	
Contracts,	896 79		896 79	
Additional work,	91 27		91 27	
Real estate: taxes, care and dis- posal,	1,570 13		1,570 13	
Legal and expert,	1,737 12		1,737 12	
Reimbursement, city of Boston,* .	600,000 00		600,000 00	
		1,347,025 20		1,347,025 20
<i>Amounts carried forward,</i> .		\$2,614,396 53		\$2,649,032 82

* The additional sum of \$518,975.74 was paid to the city of Boston in December, 1896.

	For the Year ending Nov. 30, 1896.	From the Beginning of the Work to Dec. 1, 1896.
<i>Amounts brought forward,</i>	<i>\$2,614,396 53</i>	<i>\$2,649,032 82</i>
<i>Distribution System.</i>		
Low service:—		
Pipe lines, engineering, . . .	\$31,240 52	\$42,038 76
preliminary work, . . .	8,032 74	8,056 74
contracts, . . .	441,334 27	441,334 27
additional work, . . .	11,116 93	11,116 93
Pumping station, engineering, . .	1,920 09	2,665 12
preliminary work, . . .	8 00	8 00
Reservoir, Spot Pond, engineering, . . .	2,947 10	3,017 10
preliminary and additional work, . . .	560 21	560 21
Real estate, Boston, . . .	2,486 50	2,486 50
Legal and expert, . . .	1,541 66	1,541 66
	501,188 02	512,825 29
Northern high service:—		
Pipe lines, engineering, . . .	\$8,155 74	\$9,491 18
preliminary work, . . .	1,366 37	1,373 37
contracts, . . .	69,631 99	69,631 99
additional work, . . .	1,546 62	1,546 62
Pumping station, engineering, . . .	557 83	849 06
preliminary and additional work, . . .	31 00	31 00
Reservoir, Middlesex Fells, engineering, . . .	2,611 11	2,712 91
preliminary work, . . .	483 82	483 82
Legal and expert, . . .	132 78	132 78
	84,517 26	86,252 73
Southern high service:—		
Pipe lines, engineering, . . .	\$1,391 88	\$1,803 20
Pumping station, engineering, . .	453 40	568 40
Reservoir, Quincy, engineering and preliminary, . . .	638 18	730 68
Legal and expert, . . .	1,948 33	1,948 33
	4,431 79	5,050 61
Extra high service, engineering, . .	286 73	375 73
Pipes, valves, castings, etc., at stock yards, on hand November 30, . . .	143,315 86	143,315 86
<i>Claims on Account of Diversion of Water.</i>		
Engineering, . . .	\$5,734 67	\$6,320 17
Legal and expert, . . .	6,720 39	6,820 39
Settlements, . . .	203,000 00	203,000 00
	215,455 06	216,140 56
<i>Examination of Existing Water Works.</i>		
Engineering, . . .	\$34 00	\$123 40
Legal and expert, . . .	193 33	193 33
	227 33	316 73
Total expenditures, . . .	\$3,563,818 58	\$3,613,310 33

(2) Receipts.

The total amount of receipts from rents, sales of property, etc., from Jan. 4, 1896, to Nov. 30, 1896, was \$3,400.57. The sources of these receipts are as follows :—

Forfeiture for contract awarded but not executed,	\$500 00	
Rentals from real estate,	2,047 65	
Sale of real estate and buildings,	459 00	
Land products,	821 25	
Labor, tools, supplies, etc.,	72 67	
	<hr/>	\$3,400 57

The foregoing receipts have been credited to the various objects or works as follows :—

Southborough Dam and Reservoir,	\$2,037 85	
Nashua Dam and Reservoir,	783 84	
Nashua-Sudbury Aqueduct,	78 88	
Distribution system, low service,	500 00	
	<hr/>	\$3,400 57

(3) Assets.

The value of the assets is given, as far as practicable, at cost prices :—

Desks, chairs, safes, drafting tables, plan cases, type-writing machines, electrical fittings and general office furniture and fixtures,	\$12,000 00
Record books, stamps, stationery and general office implements and supplies,	2,800 00
Transits, levels, planimeters, scales and other engineering instruments; drafting paper and general drafting supplies; outfits for cement testing, blue printing, photography, etc.,	16,400 00
Atlases, maps, portfolios and reference books,	700 00
Railroad and electric road tickets,	1,000 00
Horses, vehicles and stable supplies,	1,500 00
Revolvers, handcuffs, belts and other police supplies,	500 00
Engines, pumps, boilers, derricks, diamond and other drills, lumber, field buildings, tools and general construction supplies,	15,800 00
Stock for construction work (iron pipes, valves, man-hole castings, etc.),	142,800 00
	<hr/>
	\$193,500 00

There are numerous note and calculation books, studies, plans, etc., of great value to the Board, to which no stated value can be assigned; also real estate in the proposed Nashua Reservoir; the nearly completed dam and the partially completed reservoir in Southborough and Marlborough; a portion of the Nashua Aqueduct; and several miles of pipe line.

(4) *Liabilities.*

Unpaid bills,	\$8,800 00
Amount due on monthly pay rolls,	5,600 00
Amount due for police service in Southborough,	1,000 00
Reserved on approved monthly estimates for work done (not due until completion of contracts),	315,566 34
Balance due city of Boston for taking of Reservoir No. 5, Jan. 4, 1896,*	518,975 74
	<hr/>
	\$849,442 08

In addition to the above there are amounts which will be due on various contract sections from the time of each last monthly estimate to Nov. 30, 1896.

VI. THE WORK ACCOMPLISHED AND IN PROGRESS.

Contracts have been made by the Board for performing substantially all the work which is required to bring the waters flowing in the south branch of the Nashua River from the site of the proposed dam at Clinton to a connection with the Sudbury system, now operated by the city of Boston, and for the distribution of the water among the most of the cities and towns of the Metropolitan Water District.

These contracts are 45 in number, besides the 11 contracts for building the dam at Southborough and Reservoir No. 5, which have been assumed by the Board.

All of these contracts require the completion of the work to be performed under them during the year 1897. In almost all cases the work has been progressing favorably, and in some cases more speedily than was contemplated under the terms of the contracts. In a few instances the work has not been carried on so fast as to be satisfactory to the Board. Such progress, however, has been made, that it is believed, unless some unforeseen exigency shall arise, this

* The amount of this balance was paid to the city of Boston in December, 1896.

work will be so far completed that, on or at an early date after Jan. 1, 1898, the additional supply of water to be furnished from the Nashua River will be afforded to the portions of the Metropolitan District which are in urgent need of an increased supply. By the near completion of the dam at Southborough and the preparation of the lower portions of the Reservoir No. 5 a considerable amount of water will be stored in that reservoir during the early winter and spring months of the year 1897, so that in case of urgent need a substantial addition may be made to the existing supply from the Sudbury system.

The estimated value of the work to be performed under the 45 contracts awarded by the Board and of the work remaining to be performed under the 11 contracts made by the city of Boston, when they were assumed by the Board, is \$3,641,717.88. The estimated value of the work performed, subject to the direction of the Board, under all these contracts, to December, 1896, was \$2,029,022.12.

The expenditures of the Board to Dec. 1, 1896, chargeable to administration, have been \$42,712.13; to engineering, \$218,934.01; to construction, \$1,633,911.88; to real estate, damages and diversion of water, \$1,116,208.80; and to the purchase of the water works of the city of Boston, \$601,543.51, — a total of expenditures of \$3,613,310.33. The additional sum of \$518,975.74 was paid to the city of Boston in December, 1896.

The preliminary investigations have so far progressed that it is anticipated that during the coming year contracts will be made for the building of the great dam in Clinton, for the construction of a portion or the whole of the North Dike, for the stripping and preparation of a portion of the lands to be included in the Nashua Reservoir, for the laying of the remaining portions of the main distributing pipe lines in the Metropolitan District and for the construction of pumping engines and stations, and for building a high-service reservoir in the Middlesex Fells. It is also expected that plans will be advanced, if not completed, for the improvement of Spot Pond as a great storage and distributing reservoir.

It is gratifying to be able to state that the extended investigations and the progress of the work have developed no serious obstacles to the entire carrying out of the scheme recommended by the State Board of Health and adopted by the Act of the Legislature of 1895, and that the expenditures made and contracts awarded have not exceeded the estimates then made.

VII. THE URGENT NEED OF AN ADDITIONAL WATER SUPPLY.

The continued investigations of the Board have still further confirmed the wisdom of the Legislature of 1895 in urging speedy action for obtaining an additional water supply to meet the increasing demand of the city of Boston and the other municipalities constituting the Metropolitan Water District, and for providing against the contingencies of a season of drought or moderate rainfall. It is certain that the work imposed upon the Board was undertaken none too soon, and that every reasonable effort should be made to hasten the operations which are in progress to secure a safe and ample supply of water.

The report of the chief engineer, explaining in detail the operations of the engineering department, and various explanations and tables, are herewith presented.

Respectfully submitted,

HENRY H. SPRAGUE.
WILMOT R. EVANS.
HENRY P. WALCOTT.

Boston, Jan. 1, 1897.

REPORT OF THE CHIEF ENGINEER.

To the Metropolitan Water Board.

GENTLEMEN : — The following is a report of the operations of the engineering department for the year ending Dec. 31, 1896.

ORGANIZATION.

On Jan. 4, 1896, it became necessary to increase the engineering force in order to carry on the work of completing the unfinished Reservoir No. 5, in Southborough, which was on that date taken from the city of Boston under the provisions of the metropolitan water act. Upon the taking of this reservoir the Sudbury department was organized, with Mr. Desmond FitzGerald, who had been in charge of this work from its inception, as department engineer, and with nearly all of the engineers previously employed upon this work by the city of Boston, as assistants.

At the beginning of the year Mr. Thomas F. Richardson, engineer of the aqueduct department, not only had charge of the aqueduct, but was temporarily in charge of all work connected with the dam and reservoir to be built upon the Nashua River above Clinton. After the work of constructing the aqueduct was well under way, his duties increased to such an extent that it was thought desirable to organize another department; and on May 21 Mr. Hiram A. Miller, who previously had general charge, under Mr. Richardson, of the surveys for the reservoir, was appointed as engineer of the reservoir department. Mr. Richardson was at the same time given permanent charge of the main dam and was also retained temporarily in charge of the borings and other preliminary investigations for the dikes of the reservoir; his title was also changed to engineer of the dam and aqueduct department.

After making these changes, the engineers reporting directly to the chief engineer were as follows : —

DEXTER BRACKETT,	. .	<i>Engineer, Distribution Department.</i>
DESMOND FITZGERALD,	. .	<i>Engineer, Sudbury Department.</i>
THOMAS F. RICHARDSON,	. .	<i>Engineer, Dam and Aqueduct Department.</i>
HIRAM A. MILLER,	. .	<i>Engineer, Reservoir Department.</i>
REUBEN SHIRREFFS,	. .	<i>Principal Office Assistant.</i>
MORRIS KNOWLES,	. .	<i>Office Assistant.</i>

Mr. Joseph P. Davis and Mr. A. Fteley have continued to act as consulting engineers.

The engineering force has been increased from time to time during the year, in accordance with the requirements of the work. At the beginning of the year the engineering force numbered 68, and at the end of the year 146. In addition to members of the engineering force who were engaged upon the inspection of the work, other inspectors have been employed to inspect pipe making, pipe laying, masonry and earthwork. The maximum number so employed at any time was 30. Small gangs of men, under the immediate direction of foremen and the general direction of the engineers, have been employed to handle the water pipes received at the pipe yards, to make borings, to repair roads and to do other preliminary and minor work. The maximum number so employed at any time during the year was 97, and the number at the end of the year 74.

GENERAL STATEMENT OF THE WORK OF CONSTRUCTION.

In view of the urgent need of an additional water supply in many of the cities and towns in the metropolitan district, it has been the aim to construct as rapidly as practicable, having due regard to economy, those portions of the metropolitan water system which would soonest furnish an additional water supply, and serve to distribute it to the various municipalities. These portions are the aqueduct from the Nashua River to the Sudbury water-shed; Reservoir No. 5, upon the Sudbury water-shed, already partly constructed by the city of Boston, and the main pipe system in the metropolitan district, leading from Chestnut Hill Reservoir to Spot Pond and to the cities and towns in the district.

The existing aqueducts and other works of the city of Boston have sufficient capacity to carry as much water as is needed by the metropolitan water district at the present time from Reservoir No.

5 to Chestnut Hill Reservoir. Plan No. 1 shows the location of the main features of the metropolitan water system, and the principal existing water works of the city of Boston.

Nashua Aqueduct.

A plan and profile of the location of this aqueduct are shown upon Plan No. 2, and details of the aqueduct are shown on Plan No. 3. It has a total length of twelve miles; the first two miles are a tunnel through rock, the next seven miles a masonry aqueduct, including a bridge across the Assabet River, and the last three miles an open channel, following the course of a brook and extending to the upper end of Reservoir No. 5.

Contracts for this work were made at four different times during the year, as follows:—

Nashua Aqueduct Contracts.

DATE OF CONTRACT.	Description.	Name of Contractor.	Amount.*
Feb. 14, 1896,	Sections 2 and 3, Nashua Aqueduct, 10,308 feet tunnel, 1,011 feet masonry aqueduct.	E. D. Smith & Co., .	\$370,826 00
May 9, 1896,	Sections 4, 5, 6, 7, 9 and 10, Nashua Aqueduct, 35,501 feet masonry aqueduct.	Silvio Casparis, . .	721,580 60
June 16, 1896,	Section 8, Nashua Aqueduct, 359 feet bridge over Assabet River, 30 feet masonry aqueduct.	Jones, Pollard & Co., .	64,676 25
Sept. 22, 1896,	Section 11, Nashua Aqueduct, 15,800 feet open channel with road bridges, and two small dams.	Moulton & O'Mahoney,	89,470 00
			<hr/> \$1,246,552 85

* These figures are based upon the engineer's estimate of the approximate amount of work of different kinds to be done.

The above contracts provide for the completion of the whole length of the Nashua Aqueduct, with the exception of the very short length next to the Nashua River, which it may not be feasible to construct permanently until the masonry dam across the river is built. It is proposed during the year 1897 to make a temporary connection with the river.

Owing to a somewhat radical change in the design of the aqueduct, which has proved in practice to be very satisfactory, its careful location and the very low prices at which the contracts were

made, this work will be completed for much less than the amount of the original estimate.

Tunnel. — The progress on the tunnel has been very satisfactory indeed, as the total amount of tunnel excavated to December 26, measuring to the ends of the headings, was 6,170 feet, or 60 per cent. of the whole length of the tunnel. The length remaining to be excavated is 4,138 feet, which equals the length excavated in the fourteen weeks ending December 26.

A portion of the tunnel will require a masonry lining to support the roof, and none of this lining has as yet been built, although preparations are being made to begin the work.

Masonry Aqueduct. — The progress upon the masonry aqueduct has been much less satisfactory than upon the tunnel. The work was let later in the season, and the time consumed in perfecting the organization was such that the work was not fully organized until the autumn, when it was soon necessary to shut down, on account of the cold weather.

The completed aqueduct has a length of about 1 mile, the lower part of the masonry has been built for an additional length of 1,293 feet, making a total of 6,498 feet, or 18 per cent. of the total length to be constructed. The actual progress of the work is considerably greater than indicated by the above percentage, because quite a length of aqueduct trench is practically ready to receive the masonry; many culverts have been built, and, on the whole, by far the most difficult portions of the work have been done. Every endeavor will be made to have this work completed at the end of the next working season.

Assabet Bridge. — Although the Assabet bridge was not let until June 16, the contractors have prosecuted the work very energetically, so that the foundations for all of the seven arches have been constructed to a point above the level of the water in the mill pond crossed by the bridge, and the arch stones of three of the arches have been laid. Most of the stones required for the completion of the bridge are on the ground, and there seems to be no reason to doubt that the work will be completed ahead of the contract time.

Open Channel. — The open channel was not let until September 22, and the progress since that time has been rather slow. The amount of work to be done is small in comparison with that upon other sections of the aqueduct, and it should be completed without difficulty during the coming year.

Reservoir No. 5.

This large reservoir was originally designed by the city of Boston for the storage of the water from a portion of the Sudbury watershed, but it will also be valuable in connection with the metropolitan system of works, particularly in the next few years, before the storage reservoir upon the Nashua River is ready for use.

The construction of this reservoir involves the building of a dam, to retain in the deepest place about 65 feet of water, and the removal of trees, bushes, soil and muck from the area to be flooded with water. The soil and muck removed in the improvement of the reservoir are deposited where the water would otherwise be shallow, and faced with gravel, so that the reservoir will be surrounded with gravelly shores. Where the depth of water would otherwise be less than 8 feet, the reservoir is being excavated to this depth. Plan No. 4 shows the form which this reservoir will have when completed by the filling of the shallower portions, and shows the portions excavated and to be excavated.

The first contracts for the construction of this reservoir were made by the city of Boston, as follows: one large contract for the dam, in 1893, although work upon it was not begun until 1894; three contracts in 1894, one of them for the improvement of the reservoir and two for other work connected with the reservoir and dam; and ten contracts in 1895, seven of which were for the improvement of the reservoir and three for building roads, fences and filter beds.

On Jan. 4, 1896, when the work of constructing this reservoir was transferred to the Metropolitan Water Board, there were in force one large contract for the construction of the dam, eight important contracts for improving the reservoir and two minor contracts. These contracts were assumed by the Metropolitan Water Board, under the provisions of the metropolitan water act.

During the year 1896 the Metropolitan Water Board made eleven additional contracts, nine of which were for improving the reservoir, one for building an arch under and widening the embankment of the New York, New Haven & Hartford Railroad, where it crosses the reservoir, and another for sluice gates for the dam.

The following statement gives the gross amount of the contracts made by the city of Boston and in force at the time the works were taken by the Metropolitan Water Board, the amount of work done upon these contracts before they were taken by the Metropolitan

Water Board, and the total amount of the contracts assumed and made during the year. The figures given are the nearest approximations to the final amount of these contracts which can be made at the present time : —

Reservoir No. 5 Contracts.

Total amount of the uncompleted contracts of the city of Boston,	. \$1,051,903 54
Amount of work done on these contracts by the city of Boston,	. 512,000 00
<hr/>	
Amount of work remaining to be done by the Commonwealth,	. \$539,903 54
Contracts made by Metropolitan Water Board,	. 800,720 71
<hr/>	
Total amount of contracts made or assumed by Metropolitan Water Board,	. \$1,340,624 25

The progress on the contracts, as a whole, has been very satisfactory. The value of work done upon the contract for Dam No. 5, up to Jan. 4, 1896, was about \$284,000, and the amount done from Jan. 4 to Dec. 15, 1896, was about \$220,000. The work on this dam is nearing completion, and it should be finished within two months after resuming work upon the masonry next spring.

The improvement of the reservoir required the removal of 4,544,000 cubic yards of earth. Prior to Jan. 4, 1896, the city of Boston had removed 761,000 cubic yards; from Jan. 4 to Dec. 1, 1896, the amount removed under the direction of the Metropolitan Water Board was 2,016,000 cubic yards, leaving 1,767,000 cubic yards to be removed. The contracts provide that all of this earth shall be removed before Dec. 1, 1897, and the rapid progress made upon the work this year indicates that the work will be completed on or before the time stated.

Under a requirement of the existing contracts, the improvement of the reservoir has been practically completed up to a level 18 feet below the top of the dam, so that the reservoir can be partially filled in the spring of 1897, thereby furnishing a much-needed addition to the water supply of the city of Boston. It is expected that all of the work connected with the reservoir will be completed during the coming year, so that it may be filled in the winter and spring of 1898.

Distribution.

The completion of the Nashua Aqueduct and of Reservoir No. 5 will furnish a sufficient supply of water at Chestnut Hill Reservoir in Boston. From this point the water is to be pumped and con-

veyed through pipes to the cities and towns of the metropolitan water district. It is the aim to construct the pipe systems so that they will be ready for use by the end of 1897; but, on account of the time required to perfect plans for pumps and pumping stations and to construct and erect pumps, it will not be feasible to have any new pumps ready to operate upon the completion of the pipe lines. The surplus pumping capacity of the high-service pumping station of the city of Boston at Chestnut Hill Reservoir can be utilized to pump water for the cities and towns outside of Boston; and as these pumps will connect with Spot Pond, which has a very large capacity for a distributing reservoir, it will be feasible to maintain a supply in this way until additional pumps are ready for use. In carrying out this plan, the completion of one of the lines of 48-inch pipe from Chestnut Hill Reservoir to Spot Pond is a most important factor, and much of the work during the year has been done on this line.

The principal contracts made during the year in connection with the distribution of water may be summarized as follows:—

11 contracts with four pipe foundries for furnishing 42,875 tons of cast-iron water pipe, ranging in diameter from 48 inches to 6 inches; the total amount of these contracts is	\$869,424 86
8 contracts for pipe laying, representing a total of 19.7 miles of pipe, varying in diameter from 48 inches to 16 inches; the total amount of these contracts is	166,836 33
5 minor contracts,	18,279 59
	<hr/>
	\$1,054,540 78

The progress on these contracts has been very satisfactory, as up to the end of the year 1896 the total quantity of pipe inspected and accepted amounted to 38,080 tons, and the amount of pipe laid equalled 15 miles. The amount of pipe now on hand in the pipe yards in Somerville and Edgeworth equals a length of 13.8 miles, and the additional length contracted for, but not yet received at the pipe yards, equals 4.1 miles.

The total length of the 48-inch pipe line now being laid from Chestnut Hill Reservoir to Spot Pond is 11.7 miles, of which 7.56 miles have been laid, and existing contracts cover an additional 1.67 miles, leaving 2.45 miles for which no contracts have yet been made. The pipes across the Charles and Mystic rivers are included in the lengths for which contracts have not yet been made.

It is expected to so far complete the pipe systems during the year 1897 that water can be distributed to the cities and towns in the metropolitan water district in 1898.

Summary of Contracts to Nov. 30, 1896.

The contracts made and assumed by the Metropolitan Water Board from Dec. 27, 1895, when the first contract for construction was made, to Nov. 30, 1896, may be summarized as follows : —

PORTION OF WORK.	Number of Contracts.	Amount.
Nashua Aqueduct,	10	\$1,246,552 85
Reservoir No. 5, assumed from the city of Boston (uncompleted portions),	11	589,903 54
Reservoir No. 5, made by Metropolitan Water Board,	11	800,720 71
Distributing system,	24	1,054,540 78
Totals,	56	\$3,641,717 88
Value of work done on these contracts to dates of December estimates, . . . . .	. .	\$2,029,022 12

Force Employed on Works.

The largest force employed upon the works at any one time during the year was in the latter part of October, 1896, as follows : —

	Men.	Horses.
Contractors' force : —		
Nashua Aqueduct,	1,543	215
Dam and Reservoir No. 5,	2,040	573
Pipe laying,	525	57
	4,108	845
Day labor force,	79	
Engineers,	156	
Inspectors, not engineers,	29	
Totals,	4,372	845

A detailed statement of the work done in the different departments of the engineering force is as follows : —

RESERVOIR DEPARTMENT.

HIRAM A. MILLER, *Department Engineer.*

In this department is included the greater part of the work to be done in connection with the construction of the reservoir upon the Nashua River above Clinton, exclusive of the dam. The work upon the reservoir was, as already stated, temporarily in charge of Mr. T. F. Richardson, until May 21, when Mr. Hiram A. Miller was appointed in charge of this work, reserving, however, to Mr. Richardson the completion of the borings and other investigations to be used as the basis for locating and designing the dikes. Statements with regard to the dikes will, therefore, be found under the head of the dam and aqueduct department.

The work in this department has been almost wholly of an engineering nature, as the work of construction has not been begun. The force during the greater part of the year has been organized as follows : 1 department engineer ; 4 assistant engineers in charge of field parties, and a small office force under the immediate direction of the chief draftsman of the dam and aqueduct department. The assistant engineers are Charles A. Bowman, Chester W. Smith, Moses J. Look and Harry J. Morrison.

The force employed upon this part of the work has varied from 17, at the beginning of the year, to 25, at the end of the year.

The main office of the department has been located in Pierce's Block, Clinton, and a branch office has been maintained at West Boylston.

NASHUA RESERVOIR.

Descriptive. — In order that the subsequent statements with regard to the work done on the reservoir may be understood, I will give a brief description and statistics.

The reservoir is to be formed by constructing a masonry dam across a gorge through which the river flows just above Clinton, and by constructing dikes to the north and south of the main dam, to prevent the water from overflowing from the reservoir in other directions.

The reservoir will flood a very large area, containing a railroad, roads, houses, mills and other buildings, and it will be necessary to

build roads to take the place of those flooded, and to provide a new location for the railroad.

In order to improve the quality of the water stored in this reservoir, it is proposed to remove all of the soil and vegetable matter from its site, so that the water will come in contact only with earth which is practically free from organic matter.

*Statistics relating to the Nashua River Reservoir.**

Area of water surface (acres),	4,195
Area of water surface (square miles),	6.56
Total contents (gallons),	63,068,000,000
Length (miles),	8.41
Maximum width (miles),	2.05
Total length of shore line, not including the islands (miles),	35.40
Maximum depth (feet),	129
Average depth (feet),	46
Length of railroad flooded (miles),	6.56
Length of roads flooded (miles),	19.21
Buildings flooded : —	
Mills,	6
Churches,	4
School-houses,	6
Dwellings,	224
Inhabitants on land required for reservoir,	1,711

Land Surveys. — Owing to a provision of the metropolitan water act, that damages shall be paid for injury to lands not taken for the reservoir in West Boylston and portions of Boylston, and to the desirability of determining the boundaries of estates of which a part is to be taken for the reservoir, the area to be surveyed has been very large. Up to December 1 the total area surveyed was 11,523 acres, or about 18 square miles. Of this, 9,301 acres, or about 14½ square miles, have been plotted upon sectional plans 24 inches high and 36 inches wide, to a scale of 100 feet to an inch. Forty of these sectional plans have been completed and tracings of them have been made, and 36 are in progress; about 600 blue-prints of these plans have been made. Thirty-nine of the sectional plans have been reduced to a scale of 300 feet to an inch, and transferred to other sheets. Seven hundred and eleven deeds have been copied and 450 plots of land have been made from the descriptions contained in the

* Taken from the report of the Massachusetts State Board of Health upon a metropolitan water supply, February, 1895.

deeds, in order to compare the deeds with the surveys of the ground. One hundred and fifty-three old plans of parcels of real estate have been borrowed, and tracings of them have been made.

Relocation of Roads. — Much attention has been given to the question of roads surrounding the reservoir, to take the place of those which will be submerged by filling the reservoir. Careful surveys have been made to determine the topography, to a considerable width, for about 17 miles of road relocation, and estimates of cost have been made on 13 miles of road location. One and one-half miles of located road have been staked out, and profiles of 12½ miles of existing roads have been made.

Relocation of Central Massachusetts Railroad. — Surveys for the relocation of the Central Massachusetts Railroad through Oakdale have been made by the engineers of the reservoir department; other surveys for the relocation of this road, through Berlin and Clinton, have been made by the engineers of the dam and aqueduct department, and will be referred to subsequently.

Removal of Soil. — In order to determine the depth to which the soil should be removed, so as to leave that remaining nearly free from organic matter, 59 samples taken at different depths from the surface have been sent to Mrs. E. H. Richards, chemist at the Massachusetts Institute of Technology, for analysis; and upon the basis of these analyses, and similar analyses previously made for the State Board of Health, taken in connection with local examinations of the ground made by digging small test holes, the amount of soil to be removed has been determined. Eight hundred and sixty-nine test holes have been dug for this purpose.

By far the greater part of the soil to be removed from this reservoir is to be deposited at the site of the North Dike; but it will be more economical and better to dispose of a portion of it in filling shallow portions of the reservoir at Oakdale and elsewhere, and surveys and estimates have been made for this work.

Accurate Surveys and Levels. — As a basis for surveys of the reservoir, 53 triangulation stations, including 4 churches, were accurately located in 1895, and 5 additional stations were located in 1896. Using these triangulation stations as a basis, 21 points have been established in the reservoir as a preliminary to dividing the reservoir into squares 1,000 feet on a side. As a basis for future levels, 46

permanent iron benches, each consisting of an iron rod attached to an iron plate sunk deep in the ground, have been put in place, and the elevation of these benches above Boston city base has been carefully determined.

Survey of Nashua River. — A survey of the Nashua River and the mill ponds upon it, together with levels showing the fall of the river, have been made by the engineers of the reservoir department. This survey extends from Oakdale, at the head of the reservoir, to East Pepperell, a distance of $32\frac{3}{4}$ miles, and was made for the purpose of obtaining exact information with regard to the water power at the mills along the river.

DAM AND AQUEDUCT DEPARTMENT.

THOMAS F. RICHARDSON, *Department Engineer.*

The work now in charge of this department includes the borings and other investigations for the dams and dikes of the Nashua Reservoir, the construction of the Nashua Aqueduct, the relocation of the Central Massachusetts Railroad through Berlin and Clinton, and the gaging of the Nashua River.

After the work began along the line of the aqueduct, the organization of the engineering force was as follows: 1 department engineer; 3 engineers in charge of the three divisions of the aqueduct; 1 head draftsman in charge of the draughting office; 1 engineer in charge of river gaging and miscellaneous investigations, and a small cement testing force.

Horace Ropes, Alexander E. Kastl and Charles E. Wells are respectively the engineers of the first, second and third divisions of the aqueduct; Ernest G. Hopson is head draftsman; and David Hinckley is in charge of gagings and investigations.

The inspectors employed to inspect the work of construction were in part engineers and in part masons who had had experience in inspection. The engineering force employed upon this part of the work varied from 17 at the beginning of the year to 39 at the end of the year.

The main office of the department has been located in Pierce's Block, Clinton, and a branch office has been maintained at Northborough for the use of the engineers of the second and third divisions of the aqueduct work.

NASHUA DAM.

Masonry dam to be founded on solid rock. Length across valley at water level, 1,250 feet; maximum height of water line above surface of ground, 129 feet; above surface of rock, 184 feet; water level, 395 feet above Boston city base.*

The work of making borings, to determine accurately the form of the surface of the rock and the character of the rock at the location of this dam, was in progress at the beginning of the year, when six gangs were engaged in making pipe borings, that is, in driving pipes through the earth to the rock and washing the material encountered to the surface by water delivered at the bottom of the driven pipe through a smaller wash-pipe, and one gang was engaged in drilling into the rock with a diamond drill. In February a second diamond drill was obtained, in order to expedite the work.

The pipe borings were completed June 24, and the diamond drill borings July 9, 1896. The total number of pipe borings was 806, of which 305 were made in 1895. The aggregate length of these borings was 15,308 feet, or very nearly 3 miles. Thirty-eight diamond drill borings were made, having an aggregate length of 2,489.1 feet, of which 178 feet were drilled in 1895. The maximum depth of any hole was 286.1 feet, and the average depth 65.5 feet.

In order to operate the diamond drills, a pipe was first driven through the earth down to the solid rock, or until stopped by a large boulder, and cleaned out with a jet of water, and the diamond drill was lowered to the rock or boulder through this pipe. The lengths above given for the work of the diamond drill are the lengths actually drilled below the bottom of the driven pipe. The pipes were driven every 20 feet up and down stream and every 10 feet across the deeper portions of the valley; nearer the ends of the dam they were driven 20 feet apart in each direction. They extended both up stream and down stream, beyond the proposed location of the dam, and showed very clearly the form of the surface of the rock and the character of the earth and rock penetrated.

The results of the borings have been submitted to Prof. W. O. Crosby, geologist of the Massachusetts Institute of Technology, who has also made a very careful geological examination of the

* Boston city base, which is used as the basis of levels on the metropolitan water works, is approximately at the level of low tide. The base used upon the Boston water works is 10 feet higher.

whole surrounding country. Professor Crosby was consulted upon this matter soon after the borings were started, and we have had the benefit of his advice while making them.

On Oct. 1, 1896, he submitted his final report upon the structure and character of the rock and earth encountered at the location of the dam, a copy of which has already been sent you. In a general way the results found are as follows:—

The north-west slope of the gorge through which the river runs is composed of granite covered with a comparatively thin layer of sand or gravel. The south-east slope is composed of metamorphic slate or schist, covered above the level of the mill pond with a layer of earth about 30 feet in thickness and beneath the mill pond with a greater thickness. Above the level of the mill pond the covering on the south-east slope is nearly all an unmodified drift of boulder clay or till, while under the mill pond the drift is nearly all modified and largely sand and gravel. The contact between the granite and the schist is an igneous one, the granite having come up in a molten state and being firmly welded to the schist. If the earth were removed, the schist on the south-east side of and under the river would show a nearly regular slope down to the point of contact with the granite, and there would be at the junction of the two an abrupt wall of granite from 30 to 40 feet in height.

The erosion which occurred before the rock was covered with earth seems to have acted to a much greater extent upon the softer schist than upon the harder granite, and in this way to have produced this abrupt wall, and even in some cases an undercutting of the granite. The gorge is a narrow one, as its width 40 feet above the deepest point is only from 90 to 135 feet.

The borings have not only demonstrated that a dam can be safely built at the proposed location, but also furnish all of the information required for determining with exactness the most economical location of the dam, and for specifying with an unusual degree of accuracy the amount and character of the work to be done in preparing its foundations.

Since the completion of the borings the work of preparing the final plans of the dam has been carried on as rapidly as practicable without delaying other work which requires to be completed sooner, and it is expected that they will be ready in time to make contracts for the dam in 1897.

NORTH DIKE.

In order to obtain the full information required for the locating and designing of this dike it has been found necessary to make a great many deep driven pipe borings, and to make experiments upon the filtration of water through the materials contained in the plain across which the dike is to be built, and through the materials which are to be used in building the dike.

For this purpose three boring gangs began work April 1 and three others August 15, and the work has progressed continuously since the latter date. At the end of November 273 borings, having an aggregate depth of 30,919 feet, had been made. The results confirm those obtained by the investigations of the State Board of Health, as they show that the portion of the plain where the dike is to be located is composed mainly of very fine sand, which is nearly impervious to water. The borings of the easterly section of the dike are approaching completion, but those on the westerly section, which is much less difficult to construct, have not yet been begun.

Professor Crosby has been consulted with regard to the method of conducting and the interpreting of the results obtained from these borings, and has submitted a preliminary report. When the borings are completed he is to submit a final report upon the geological features of the plain and the interpretation of the results of the borings.

For the filtration experiments a rough building, 70 feet long and 25 feet wide, has been built. This contains a water-tight wooden tank, 60 feet long, 6 feet wide and 8 feet deep, and five circular galvanized-iron tanks, 5 feet in height and about 28 inches in diameter. Inside of the large tank a dam of soil 8 feet high has been formed, and the water has been filled in one end of the tank to a depth of about 8 feet, while the other end has been kept drained. The amount of water filtering through the soil has been measured, and the ability of the soil to support the pressure of water under very unfavorable circumstances has been determined. This experiment has been made with soil not consolidated in any way, and again with soil deposited in water. It has been found that the soil is practically water-tight. The smaller tanks have been filled with various materials of which the plain across which the dike is to be constructed is composed, and with soils of various kinds which are to be used in the construction of the dike, and the filtering capacity

of these materials is being determined. These experiments are still in progress.

One other filtration experiment is being made by running water from the town supply upon a filter bed constructed in the plain near the experiment station. The filter bed has an area of $\frac{1}{20}$ of an acre and a maximum depth of 6 feet. Pipes have been driven down to the level of the ground water in all directions around this filter bed, and the effect of the water run into the ground at this place upon the height of the water in the ground is being noted. This experiment is intended to show, by the rise of the water in the ground in the vicinity of the filter bed, the extent to which water will filter through the material found at the lower depths of this sandy plain.

SOUTH DIKE.

This dike differs from the North Dike in that it follows, for the greater part of its length, a ridge nearly or quite at the proposed level of high water in the reservoir, and in this ridge the solid rock is near the surface. In order to determine the exact depth to the rock, steel rods have been driven down to it at 566 places, the aggregate length driven being 3,657 linear feet. In order to determine the depth of the rock where it was too far below the surface to be reached in a satisfactory manner with the steel rods, pipes have been driven in the manner already referred to. The pipe borings were made from April 14 to May 28, and from June 24 until August 15; 67 borings, having an aggregate depth of 1,409 feet, were made.

In order to determine the character of the rock, a diamond drill was used at the South Dike from July 10 to August 14, making 7 borings, aggregating 324.2 feet in depth. The maximum depth of any diamond drill boring was 65.3 feet, and the average depth 46.3 feet. The results obtained from these borings agree substantially with those obtained from the preliminary borings by the State Board of Health, but are much more complete, and furnish all of the information required for the economical and safe location of this dike.

RELOCATION OF CENTRAL MASSACHUSETTS RAILROAD.

The construction of the Nashua Reservoir requires the relocation of the Central Massachusetts Railroad for a distance of about $6\frac{1}{2}$ miles, and for the purpose of determining the best line for this relocation

four lines were surveyed during the investigation made by the State Board of Health.

During the present year one additional line has been surveyed from the Central Massachusetts Railroad at West Berlin to the location of the Worcester, Nashua & Rochester Railroad in Clinton, and estimates of the cost of reconstructing the railroad on this line have been made.

A survey has also been made and estimates begun of another route from West Berlin, following parallel with the present line of the New York, New Haven & Hartford Railroad.

The Central Massachusetts Railroad and the Worcester, Nashua & Rochester Railroad are both operated by the Boston & Maine Railroad.

NASHUA AQUEDUCT.

Preliminary Work.

The work preliminary to the letting of the contracts for the construction of the Nashua Aqueduct, begun and far advanced toward completion in 1895, was continued at the beginning of 1896. The location of the line had been quite definitely determined at the end of 1895, but much work remained to be done in connection with the taking of lands for the aqueduct and in making additional soundings to determine the depth to the rock, and in the open channel the depth of the mud and soil to be excavated; also in making borings to determine the character of the foundation for the Assabet bridge, and the character of the material to be excavated along the line of the open channel. The following soundings and borings were made: —

One hundred and sixty-one steel rod soundings, having an aggregate depth of 1,903 feet, to determine the position of the rock to be encountered in building the lower $1\frac{1}{2}$ miles of the masonry aqueduct.

One hundred and thirty-two steel rod soundings, having an aggregate depth of 1,782 feet, along the upper two miles of the open channel, and near Sawin's Dam.

Three hundred and ninety-nine soundings, made with a gas pipe pushed down by hand, to determine the depth of mud and soil in Sawin's Mill Pond.

Ten borings, having an aggregate depth of 391 feet, at the site of the Assabet bridge.

Twelve pipe borings, having an aggregate depth of 264 feet, near the lower end of the masonry aqueduct.

Twenty-eight borings, having an aggregate depth of 409 feet, taken every 500 feet along the line of the open channel.

Estimates were made of the approximate quantities of work of various classes to be done in connection with the contracts.

Sections 2 and 3, — Rock Tunnel.

Contractor, E. D. Smith & Co.; date of contracts, Feb. 12, 1896; amount of contracts, \$370,826; length of tunnel, 10,308 feet; width where lined with brickwork, 12 feet 2 inches; where unlined, 13 feet 6 inches; height where lined with brickwork, 10 feet 10 inches; where unlined, 11 feet 10 inches; length of aqueduct not in tunnel, 1,011 feet; width, 11 feet 6 inches; height, 10 feet 6 inches.

Owing to the weather and to the delays incidental to organizing a work where a large amount of machinery is required, the contractor did not begin the work of excavating until March 31, 1896, and it was as late as July 27 before work was in progress at all of the four shafts and at the portal.

A side track was put in from the Central Massachusetts Railroad to a point near Shaft No. 4. A very complete plant was provided for excavating the shafts and tunnel, the whole of the machinery, including drills, pumps and hoists, being operated by compressed air. The compressor plant consists of two double Rand duplex compressors, having cylinders 20 by 36 inches, the compressors being rated at about 250 horse-power each. Four boilers, of 100 horse-power each, were set up near the compressors at a point where coal could be unloaded directly into the boiler house.

From the compressors the compressed air is conveyed to shafts Nos. 3, 2 and 1 through wrought-iron pipes 8, 6 and 4 inches in diameter, and to the portal by a pipe 4 inches in diameter. The most distant shaft is about 1.5 miles from the compressors, and the air is furnished to it with but little loss of pressure.

The headquarters of the contractors are at Shaft No. 3, where many buildings have been erected of sufficient capacity to accommodate in all about 300 men. The laborers employed upon the work are mainly negroes. The number of men employed on the tunnel construction during the week ending Dec. 5, 1896, was 392.

The tunnel, as far as excavated, is wholly through rock, and it is expected that it will continue in rock throughout the entire length. For about 600 feet at the upper end of the tunnel, and for nearly all

the distance from Shaft No. 3 to the portal at the lower end, the rocks encountered are sedimentary rocks, mainly metamorphic slates and schists with unstratified beds of slaty quartzite. The remainder of the tunnel is being excavated through igneous rocks, either granite or diorite.

In some portions of the slate, schist and quartzite the rock is soft and seamy and requires timbering to support it during construction, while through the diorite and granite the rock is very hard and self-supporting.

The portions of the tunnel now timbered, and others where the material in the seams is liable to disintegrate and permit the rock to fall, will be lined with brickwork, but none of the lining has as yet been built.

Although the work of excavating under these contracts was begun at a late date, the plant provided was so complete and the work has been so well organized and directed that the progress since the excavation began has been very satisfactory indeed, and at the present rate the excavation of the tunnel will be completed far ahead of the contract time.

The dates of beginning the excavation of different parts of the work are as follows : —

	1896.
Shaft No. 1,	June 27.
Tunnel at Shaft No. 1,	July 11.
Shaft No. 2,	May 5.
Tunnel at Shaft No. 2,	June 20.
Shaft No. 3,	April 20.
Tunnel at Shaft No. 3,	June 27.
Shaft No. 4,	March 31.
Tunnel at Shaft No. 4,	May 23.
Approach to portal,	July 27.
Tunnel at portal,	October 10.

In excavating the tunnel, a “ heading ” is first excavated, which comprises only the upper half of the tunnel, and the lower half, or “ bench,” is excavated subsequently.

The distances, in feet, from the shafts or the portal to the “ headings ” and to the “ benches,” Dec. 1, 1896, were as follows : —

	Heading.	Bench.
Shaft No. 1, east,	602	519
Shaft No. 2, west,	703	655
Shaft No. 2, east,	753	678
Shaft No. 3, west,	625	538
Shaft No. 3, east,	655	592
Shaft No. 4, west,	568	534
Shaft No. 4, east,	832	759
Portal, west,	387	322
Totals, December 1,	5,125	4,597
Totals, December 26,	6,170	5,799

The lengths, in feet, of uncompleted portions between headings on December 1 were as follows : —

Between Shafts No. 1 and No. 2,	1,624
Between Shafts No. 2 and No. 3,	1,367
Between Shafts No. 3 and No. 4,	1,234
Between Shaft No. 4 and portal,	958
Total, December 1,	5,183
Total, December 26,	4,138

None of the aqueduct not in tunnel on Section 3 has been built, but in making the approach to the portal a portion of the trench in which the aqueduct is to be built has been excavated.

Sections 4, 5, 6, 7, 9 and 10, — Masonry Aqueduct.

Contractor, Silvio Casparis ; date of contracts, May 9, 1896 ; amount of contracts, \$721,580.60 ; length of aqueduct, 35,501 feet ; width, 11 feet 6 inches ; height, 10 feet 6 inches ; inclination of aqueduct, 1 foot in 2,500.

These six contracts include all of the masonry aqueduct except the short portion already mentioned on Section 3 and 30 feet to be built in connection with the Assabet bridge. For the greater part of the distance the aqueduct is being built partly or wholly in excavation ; but there are several points where the foundations of the aqueduct are above the level of the ground, and in such cases it is being built on embankments of earth, consolidated by being deposited in three-inch layers and rolled with heavy grooved rollers.

The position of the aqueduct in excavation and on embankments is shown upon Plan No. 3, upon which is also shown cross-sections of the masonry. The section on the left is the ordinary section of the aqueduct in dry earth, having a bottom and side walls of American cement concrete, lined with one course of brick masonry and an arch of Portland cement concrete. The American cement concrete is mixed in the proportion of five parts of stone, two parts of sand and one part of cement; the Portland cement concrete in the proportion of four and one-half parts of stone, two and one-half parts of sand and one part of cement.

The centres upon which the concrete arch is laid are covered with galvanized iron, to which a lubricant is applied just before laying the concrete. There has been no trouble from the concrete adhering to the centres, and the interior of the arch after removing the centres is smooth. The arch is subsequently given a wash of Portland cement, applied with a brush. The section of the aqueduct is a very economical one, and, as far as tested, it has proved to be an unusually strong one.

Where the aqueduct is below the level of the water in the ground, two courses of brick are laid in the invert in addition to the thickness of concrete shown in the ordinary section. In wet places a light platform of boards with a wooden drain in the centre is used to keep the concrete dry until it is set. If the earth in the bottom of the trench will not stand at the slope of the regular section of the bottom of the aqueduct, it is excavated to a less steep slope and the concrete walls are carried deeper, as shown by the dotted lines.

None of the aqueduct has yet been constructed on a rock foundation, but it is proposed in such cases to build the brickwork solidly to the rock, as shown in one of the sections on the right side of Plan No. 3.

At the crossings under railroads, and at other places where an unusual strain will come upon the masonry, the aqueduct section is made stronger.

Sections 4, 5, 6 and 7 of the aqueduct are located most of the way through sloping sandy or gravelly ground, and the excavation for the aqueduct does not reach below the level of the water in the ground. On sections 9 and 10, on the other hand, the water level in the ground is generally above the level of the aqueduct, and for a part of the way quicksands and hard material are encountered,

so that these two sections are far more difficult to construct than the others.

On June 23, 1896, the Board assented to the subletting of sections 5 and 6 to Smith & Burden of Long Island City, New York.

As soon as the contracts were let the contractor began the preparatory work of collecting the required plant, building camps for the men, etc., and in a short time began the excavation of the aqueduct trench on Section 10. There was considerable delay in beginning the work upon the aqueduct masonry.

The dates of beginning excavation and aqueduct masonry upon the different sections are as follows : —

[SECTIONS.	DATE OF BEGINNING.	
	Excavation.	Aqueduct Masonry.
Section 4,	June 23, 1896.	Sept. 21, 1896.
Section 5,	July 9, 1896.	Aug. 26, 1896.
Section 6,	July 2, 1896.	Sept. 30, 1896.
Section 7,	June 11, 1896.	July 28, 1896.
Section 9,	June 12, 1896.	Sept. 18, 1896.
Section 10,	May 25, 1896.	July 29, 1896.

The largest force employed at any time on these sections was during the week ending Oct. 10, 1896, when 1,223 men and 171 horses were on the work.

The progress upon the six sections of the aqueduct has been unsatisfactory, and the value of the work done has been far less than the contract requirements. The contract provides that the value of the work done on Dec. 1, 1896, shall equal two-fifths of the total amount of the contracts, and this sum in the present case amounts to about \$289,000; the value of the work done to December 1 was \$167,000, leaving a deficiency in the value of work done of \$122,000. This statement does not fairly represent the progress of the work toward completion, as the work already done has been, to a large extent, earthwork, which requires much more labor on the ground for a given amount of money than masonry, of which the value is largely in the materials prepared elsewhere and brought upon the ground. The more difficult portions of the work have been far advanced, the work on Section 10, the most difficult of all,

having progressed beyond the contract requirements. At the end of the season the work was well organized, and it was advancing quite rapidly.

The following is a tabulation showing the number of linear feet of masonry built and to be built on the several sections : —

SECTIONS.	FOUNDATION AND SIDE WALLS.		ARCH.	
	Built.	To be Built.	Built.	To be Built.
Section 4,	457	5,243	431	5,269
Section 5,	862	4,438	689	4,611
Section 6,	188	6,212	138	6,262
Section 7,	770	4,773	737	4,806
Section 9,	771	5,497	529	5,739
Section 10,	3,450	2,840	2,681	3,609
	6,498	29,003	5,205	30,296

In addition to the aqueduct masonry, 14 masonry culverts are required to carry streams under the aqueduct. Of these, 9 are either built or the work upon them is far advanced, while on the remaining 5 little or no work has been done. At the end of the masonry aqueduct a terminal chamber is to be constructed, and a large part of the excavation for this chamber has been made and much of the stone for it has been delivered.

The greatest difficulty encountered was through the swamp on Section 9, where the bottom of the trench was of quicksand which was very difficult to handle. The work through the quicksand has been practically completed, and it is not expected that any more quicksand will be encountered.

On Section 10 some very hard material was encountered in the excavation at one place, and a difficult railroad crossing has been completed.

Section 8, — Assabet Bridge.

Contractor, Jones, Pollard & Co.; date of contract, June 16, 1896; amount of contract, \$64,676.25; length of bridge, 359 feet; length of masonry aqueduct not on bridge, 30 feet; character of structure, 7 granite arches (1 over a road and 6 over a mill pond) supporting an aqueduct; span of arches, 29.5 feet; height of arches above surface of mill pond, 17 feet.

This bridge (see Plan No. 3) crosses a mill pond on the Assabet River. The lower part of the aqueduct upon the bridge has the

same form as the aqueduct at other places, but, for the upper part of the aqueduct upon the bridge, vertical walls covered with iron beams and arches are substituted for the semi-circular arch. Trouble has been occasioned in the case of masonry aqueduct bridges from leaks caused by movements of the masonry due to temperature, and in the present case it has been thought best to dispense with all systems of drainage in the interior of the bridge, and to make the aqueduct absolutely water-tight by inserting a continuous lining of sheet lead back of the 8 inches of brick masonry forming the interior lining of the aqueduct.

In order to construct the bridge it was found necessary either to drain the mill pond or to build the piers under the protection of a coffer-dam. It was found that the cost of the coffer-dam would probably be less than the amount that would have to be paid for drawing down the mill pond, and there were other advantages, so that it was decided to use the coffer-dam.

During the season of 1896 all of the work requiring the protection of the coffer-dam has been completed, as all of the piers are now finished to a point above the level of the water in the mill pond. In addition to this, both abutments have been completed, three of the arches have been turned, and a considerable amount of granite and concrete masonry has been put in place above the level of the springing line of the arches. The centre upon which the arch crossing the road was built has been removed, so that the whole of the space under the arch is available for road purposes. The portions of masonry built are shown in red on Plan No. 3.

The stone for the bridge is obtained from the New England Granite Works of Concord, New Hampshire, and is very satisfactory in quality and appearance. In addition to the stone already laid there is a large quantity at or near the site of the bridge, and there seems to be no reason why this work should not be completed long before the contract time of completion, Nov. 1, 1897.

Section 11, — Open Channel.

Contractor, Moulton & O'Mahoney; date of contract, Sept. 22, 1896; amount of contract, \$89,470; length of section, 15,800 feet.

This section of the aqueduct extends from the lower end of the masonry aqueduct to the head of Reservoir No. 5 of the Sudbury system. It follows the general course of a brook which flows into Reservoir No. 5. The brook meandered through the bottom of the

valley, and at times of high flow spread out over the meadows and swamps which border the brook. Towards its lower end it entered a narrow mill pond, a part of which was very shallow and had a muddy bottom.

The contract provides for the excavation of a channel 20 feet wide on the bottom, with slopes of 3 horizontal to 1 vertical, down to the head of the mill pond. A new dam is to be constructed at the site of the old mill-dam, and the pond is to be retained. The mud and soil under the pond are to be removed, and it is to be deepened.

In order to avoid the necessity of protecting the sides of the channel with riprap, a second dam is to be built across it at a point midway of its length, and the channel is to be made of such depth that the two dams will retain a minimum depth of from 5 to 6 feet of water in the channel. As a result, the current will not be strong enough to move the coarse sand and gravel with which the inner slopes of the channel are to be lined, even when the area of the water section is diminished by the formation of ice at the surface.

The dams are to be constructed of masonry, and to have spillways about 140 feet long, so that there will be little fluctuation of the height of the water in the pond or channel.

Four public ways and two or three private ways crossing the channel are to be maintained, and it is proposed to construct stone arch bridges for this purpose.

The work upon this section was begun too late in the season for the construction of any masonry in 1896. The contractor began the excavation at the site of the mill pond October 3, and later began excavating the channel a mile or more up from the lower end with a steam shovel. At the end of the year the work was progressing much more rapidly than before, and, as the work is not of great magnitude, it should be easily finished during the coming year.

S U D B U R Y D E P A R T M E N T .

DESMOND FITZGERALD, Department Engineer.

The work in charge of this department at the present time is the construction of Dam and Reservoir No. 5, and an additional line of 48-inch pipes from Dam No. 3 to Dam No. 1.

On January 4, when this work was taken from the city of Boston, the engineering force appointed by the Metropolitan Water Board consisted of nearly all of the engineers previously employed by the

city of Boston upon this work, and numbered 25. At the end of the year the engineering force was organized as follows: 1 department engineer; 1 principal assistant engineer; 1 division engineer; 9 assistant engineers in charge of various sections of the work; 1 draftsman.

William C. Hall is principal assistant engineer, Edward S. Larned division engineer, Ellery C. Appleton, Frank A. Bayley, Benjamin F. Goodnough, Oscar S. Heyer, Almon A. Platts, Daniel W. Cole, William Smiddy, Walter W. Patch, Bertram H. Davis, assistant engineers in charge of various sections of the work, and Fred F. Moore draftsman.

Each of the assistant engineers has a small party and is in direct charge of the work in progress under one or more contracts. The total number engaged upon the engineering force at the end of the year was 39.

In addition to the inspectors of work, a physician was employed as sanitary inspector, and he has an assistant.

The office of the department engineer is at 3 Mt. Vernon Street, Boston, and the main office of the department at the works is at Fayville, near the dam. Several branch offices were provided at different points around the reservoir as headquarters for the different assistant engineers.

DAM NO. 5.

Contractor, Moulton & O'Mahoney; date of contract, July 27, 1893; approximate amount of contract, \$537,000; masonry spillway, 300 feet long, and gate house founded upon solid rock in the deepest part of the valley; the remainder of the dam, earth embankment with concrete core wall extending to the rock; length across valley at water line, 1,865 feet; maximum height of water line above surface of ground, 65 feet; above surface of rock, 70 feet; water level, 260 feet above Boston city base.

Cross-sections of the spillway of the dam and of the earth embankment and core wall may be seen upon Plan No. 4.

This work, when it was taken from the city of Boston, was rather more than half done. About the middle of April the dam was stripped of its winter covering, and work upon it was resumed. The work upon the masonry was prosecuted diligently up to the middle of November, at which time the spillway was completed to within a few feet of the top, and the substructure of the gate house was nearly finished. The large embankments containing the core walls have been carried nearly to grade, but there is still considerable work to be done in placing the coating of soil on the downstream side of the dam and in paving the upper slope.

The largest force employed upon this work at any time during the year was in July, when 436 men and 126 horses were at work upon it.

IMPROVEMENT OF RESERVOIR NO. 5.

Descriptive. — For the purpose of improving the quality of the water stored in this reservoir, the soil and other material containing organic matter is being removed from its site, and in places where the depth below high-water mark is less than 8 feet it is excavated to this depth. In order to diminish the cost of the work, and to furnish a place for depositing the material removed from the reservoir, the excavated material is deposited in what would otherwise be the shallow portions of the reservoir, which diminishes very largely the area from which the soil has to be stripped and the amount of the shallow flowage excavation.

Plan No. 4 shows by full lines the edge of the finished reservoir and by the dotted lines the outer limits of the filling. A typical section is also given on the same plan, to show the method of improving the reservoir.

The embankments of soil and muck are faced on the water side with a layer of coarse gravel, so that the whole of the bottom and sides of the reservoir, with the exception of a very small area at one point, where the mud has excessive depth, will be sand, gravel or other material practically free from organic matter.

Contracts for improving the Reservoir. — For the purpose of making contracts, the reservoir is divided into seventeen sections, lettered from A to Q. Contracts for sections A to H inclusive were made by the city of Boston, and assumed on Jan. 4, 1896, by the Metropolitan Water Board. Those for sections I to Q inclusive were made by the Metropolitan Water Board. The locations of the sections are shown on Plan No. 4.

In some cases they include the work of raising and riprapping the slopes of roads which would otherwise have been submerged, and of constructing culverts through the roads. On the branch of the reservoir through which the water of the Nashua River is to flow, the culverts are of large size.

Bids were received for sections I to Q inclusive on April 21, and the contracts were executed on April 27 for all sections except K. In this case there were two bidders for doing the work at the smallest sum bid, which was \$56,240. On this account, and because the

price appeared high, the section was re-advertised, and bids were received on May 7 for doing the work for \$45,600, or \$10,640 lower than the lowest bid at the first letting.

The following table shows the progress of the earth excavation for the improvement of the reservoir up to Dec. 1, 1896. The portions of the reservoir excavated and not excavated are shown upon Plan No. 4.

Progress of Earthwork, Improvement of Reservoir No. 5, to Dec. 1, 1896.

CONTRACTOR.	Sec- tions.	Total to be moved.	Moved by Boston prior to Jan. 4, 1896.	Moved by Metropolitan Water Board, Jan. 4, 1896, to Dec. 1, 1896.	Total moved to Dec. 1, 1896.	Remaining to be moved Dec. 1, 1896.
		Cu. Yards.	Cu. Yards.	Cu. Yards.	Cu. Yards.	Cu. Yards.
Auguste Saucier, . . .	A	245,000	121,707	4,037	125,744	119,256
Moulton & O'Mahoney, . .	B	215,000	59,644	145,356	205,000	10,000
Malone & Strang, . . .	C	354,000	91,631	230,369	322,000	32,000
Auguste Saucier, . . .	D	257,000	136,043	117,957	254,000	3,000
Charles Linehan, . . .	E	230,000	106,125	118,875	225,000	5,000
Newell & Snowling, . . .	F	196,000	113,122	80,878	194,000	2,000
Charles Linehan, . . .	G	151,000	81,214	68,786	150,000	1,000
Moulton & O'Mahoney, . .	H	181,000	51,698	118,302	170,000	11,000
Harry P. Nawn, . . .	I	247,000	—	169,800	169,800	77,200
Moulton & O'Mahoney, . .	J	168,000	—	152,400	152,400	15,600
Blagen & Bush, . . .	K	152,000	—	91,900	91,900	60,100
Moulton & O'Mahoney, . .	L	295,000	—	126,300	126,300	168,700
Harry P. Nawn, . . .	M	365,000	—	90,000	90,000	275,000
Thos. Nevins & Sons, . .	N	145,000	—	130,200	130,200	14,800
Washburn & Washburn, . .	O	550,000	—	85,000	85,000	465,000
Harry P. Nawn, . . .	P	293,000	—	143,000	143,000	150,000
Washburn & Washburn, . .	Q	500,000	—	143,000	143,000	357,000
		4,544,000	761,184	2,016,160	2,777,344	1,766,656

It will be seen by reference to the table that on the whole excellent progress has been made. The work upon the older contracts was nearly finished, except upon Section A, where scarcely any work was done during the year, because certain negotiations for the settlement of land damages were not completed until too late in the season. The newer contracts provided for the completion of the work Dec. 1, 1897, and 42 per cent. of the work was done between the date of letting the contracts (April 27, 1896) and Dec. 1, 1896, which is a very satisfactory progress.

The percentage of the work done by the different contractors is as follows : —

Harry P. Nawn, sections I, M and P,	45 per cent.
Moulton & O'Mahoney, sections J and L,	60 per cent.
Blagen & Bush, Section K,	60 per cent.
Thomas Nevins & Sons, Section N,	90 per cent.
Washburn & Washburn, sections O and Q,	22 per cent.

It will be noticed that the slowest progress has been made by Washburn & Washburn, and this is owing in part to the nature of the excavation upon sections O and Q, much of which has a depth of ten feet in very soft material. Owing to the difficulties encountered in the excavation of this material, the contractor has been given permission to excavate and convey the material by the use of a pumping dredge and pipes leading to the dumping areas. The scow and machinery are now building. It is hoped that the contractor will be able to handle the material very rapidly after getting the new plant in operation. A part of the same deep excavation is included in Section M, and scarcely any of the work upon it has as yet been done. The method of handling the material on this section has not been fully determined.

NEW YORK, NEW HAVEN & HARTFORD RAILROAD.

On Aug. 6, 1896, an agreement was made with the New York, New Haven & Hartford Railroad by which the Metropolitan Water Board was allowed to construct a new stone arch bridge through the railroad embankment, for conveying the water, and was required to widen the embankment of the railroad and riprap the slopes. Arrangements were made with the railroad company for constructing a temporary bridge of about 100 feet span, to support the tracks while the work of building the stone arch was in progress.

The contract for the stone arch and for widening the railroad embankment was made with Holbrook, Cabot & Daly, Aug. 17, 1896, and they prosecuted the work very energetically, and completed it in a very satisfactory manner early in December, the total cost of the work done by them being \$33,400.21.

ROADS.

The construction of Reservoir No. 5 necessitated the abandonment of several miles of roads and the construction of new ones.

Contracts for very nearly all of this work had been made by the city of Boston, but in order to resurface the roads and make some changes which were thought desirable, a small day labor force was started on the work May 26, and the roads were resurfaced and put in good order by the beginning of the autumn.

In compliance with an urgent request from the authorities of the town of Southborough, the road which crosses the reservoir north of and parallel with the railroad was made 10 feet wider than originally intended. This work was done by the contractor for Section D at the contract price for excavation.

SANITARY INSPECTION.

In the construction of other reservoirs connected with the water supply of the city of Boston it had been found that where a large number of laborers are gathered in "camps" there is danger of epidemics of diseases, as, for instance, typhoid fever. Arrangements were therefore made for a system of sanitary inspection to cover the entire work of the Metropolitan Water Board within the Sudbury water-shed, and C. P. Jones, M.D., of Southborough, was appointed as sanitary inspector, and given an assistant. Regulations were made with regard to the construction, use and disinfection of latrines, and with regard to other matters which are necessary to prevent the water supply of the city of Boston from becoming polluted. The results during the year have been very satisfactory, as there has been very little sickness and no epidemics, and the streams have been well protected from pollution.

AMOUNT OF WORK DONE.

The quantity of contract work done in this department during the year to December 1 is approximately as follows: —

Earth excavation,	2,200,000 cubic yards.
Riprap,	24,300 cubic yards.
Rubble-stone masonry,	8,724 cubic yards.
Concrete masonry,	8,648 cubic yards.
Plastering,	5,809 cubic yards.
Ashlar,	2,533 cubic yards.
Split-stone masonry,	567 cubic yards.
Paving,	282 cubic yards.
Stone wall,	443 rods.

ENGINEERING.

The work of the engineering department has related mainly to the construction of the reservoir, but surveys have also been made with reference to locating the 48-inch pipe line from Dam No. 3 to Dam No. 1.

DISTRIBUTION DEPARTMENT.

DEXTER BRACKETT, *Department Engineer.*

The work in charge of this department comprises the pipes, pumping stations, distributing reservoirs and other works in the metropolitan district.

The force is organized as follows: 1 department engineer; 3 assistant engineers in charge of parties engaged on surveys and construction, and an office force, under the charge of 3 engineers reporting directly to the department engineer, engaged upon designing, investigations, and the work connected with the making and delivery of cast-iron pipes.

William E. Foss, John L. Howard and Caleb M. Saville are assistant engineers, in charge of surveys and construction; William B. Fuller office assistant, in charge of miscellaneous designs and investigations; Alfred O. Doane special assistant to department engineer, engaged in organizing and supervising pipe yards and upon designing and inspecting; and Alfred D. Flinn office assistant, engaged upon pipe accounts and designs of pipes, special castings and valves.

The total engineering force employed in this department at the beginning of the year was 18, and at the end of the year 27.

GENERAL PLAN OF DISTRIBUTING SYSTEM.

The water supplied by the Metropolitan Water Board will for a time come wholly through the present aqueducts of the city of Boston to Chestnut Hill Reservoir, from which water is now supplied by gravity to the lower portions of Boston, and by pumping to the higher portions. There is at present a high-service pumping station at the reservoir.

Plan No. 5 shows the boundaries of the present metropolitan water district, the location of pipes and pumping stations, and the progress of the work of pipe laying to Dec. 1, 1896.

In order to supply the communities north of the Charles River, the water is to be pumped at Chestnut Hill Reservoir through two

lines of 48-inch cast-iron pipes to them, and to Spot Pond which will be used as a distributing reservoir. These are the main pipes of the low-service system, but a branch pipe, 48 inches and 42 inches in diameter, is to be laid from Malden to supply Everett, Chelsea, and East Boston, and, to some extent, Charlestown and the northerly portions of Boston proper.

The water is maintained in Chestnut Hill Reservoir at an elevation of 134 feet above Boston city base, and Spot Pond, when full, is at an elevation of 154 feet, or 20 feet higher than Chestnut Hill Reservoir. These low-service pipe lines, and those already leading to the city of Boston, will supply water to all of the lower portions of the metropolitan water district, and to by far the larger part of the population in the district. In order to supply the water to the higher portions, there are to be two additional systems, shown in blue upon Plan No. 5, one the southern high-service system, which is to be an extension of the present high-service system of the city of Boston, and the other the northern high-service system, which is wholly new. In addition to these principal systems there is to be a small system for supplying some very high lands at the extreme southern end of the metropolitan water district. This system is indicated upon the plan by two parallel dotted red lines.

PIPES.

It was decided in 1895 that cast iron should be used as the material for the pipes of the distributing system.

The pipes required are, to a large extent, from 48 inches to 36 inches in diameter, and, as there were but four pipe foundries fitted for making pipes of these sizes and so located that they could deliver the pipe economically in Boston, it was thought there might be delays in getting the pipes. When the first contract was made, Dec. 27, 1895, although the pipes were let to the lowest bidder, a somewhat higher price was paid for a contract for 12,500 tons than it would have been necessary to pay for half of this amount. It was thought best, however, to incur the additional expense, in order to insure practically a year's output from one of the largest of the foundries.

The financial depression of the year 1896 was very favorable to this part of the work, as the cities and towns usually requiring these large-sized pipes purchased very few, and, as a consequence, the other three foundries furnished pipes for these works upon very favorable terms.

In all, eleven contracts have been made with the four foundries for furnishing 42,875 tons of pipe, and 45 tons have been ordered without a contract, making a total of 42,920 tons.

These contracts provide for practically all of the pipes which are to be laid north of the Charles River, and for the pipe lines from Chestnut Hill Reservoir to the Charles River, and they represent by far the greater part of the pipe required for the whole metropolitan water district.

Every pipe made has been subjected to careful inspection by inspectors stationed at the foundries, and tests to determine the transverse breaking strength of the iron are made daily.

Yards for the storage of the pipes were established in Somerville near the Union Square station on the Fitchburg Railroad, and in Malden at the Edgeworth station on the Boston & Maine Railroad, at both of which points very good facilities were obtained for storing the pipes. Late in the year, in order to be able to store additional pipes for use during 1897, a third yard was established in Somerville, adjoining the Somerville station on the Fitchburg Railroad.

A very large part of the pipes contracted for has already been delivered, and it is expected that all will be delivered in the early spring, making a total of about 23,260 tons of pipe ready to be laid as soon as the frost is out of the ground.

The following list gives the number of tons of pipes and of special castings called for by the contracts made to Nov. 30, 1896, and by an order for 45 tons of pipes for which no contract was made:—

32,220 tons of 48 inch pipes.

2,350	"	"	42	"	"
1,700	"	"	36	"	"
1,450	"	"	30	"	"
520	"	"	24	"	"
2,470	"	"	20	"	"
1,230	"	"	16	"	"
130	"	"	12	"	"
20	"	"	10	"	"
35	"	"	8	"	"
30	"	"	6	"	"
5	"	"	4	"	"

Total, 42,160 tons.

760 tons of special castings.

Total, 42,920 tons.

VALVES AND OTHER IRON WORK.

Special designs were made for valves to be placed on the lines of the pipes, the sizes varying from 12 inches to 36 inches; for cast-iron frames and covers for blow-off and air-valve chambers, and for beams and plates to be used for covering the larger chambers used for the 30-inch and 36-inch valves.

Two contracts for making valves were made with J. H. Long; one on March 27, 1896, for furnishing 20 36-inch valves, and the other on June 1, 1896, for furnishing 52 valves of sizes varying from 12 inches to 24 inches. The work on these contracts has been delayed for various reasons, and but 15 valves have thus far been delivered.

A contract was made with the Chelmsford Foundry Company, under which it has furnished 125 sets of cast-iron frames and covers, at a cost of \$733.59.

A contract was made with the New Jersey Steel and Iron Company, under which it has furnished 25 sets of steel beams and plates, at a cost of \$1,041.

PIPE LAYING, LOW-SERVICE PIPE LINES.

It has been the aim to advance as rapidly as possible the construction of one of the two lines of 48-inch pipes leading from Chestnut Hill Reservoir to Spot Pond, and the line chosen is one passing through Brookline, a narrow portion of Boston, Cambridge, Somerville, Medford, Malden, Melrose and the easterly portion of Stoneham to Spot Pond.

This pipe in its course crosses Charles River, from Boston to Cambridge, a short distance above the Cottage Farm station of the Boston & Albany Railroad, and Mystic River, from Somerville to Medford, just below the Middlesex Avenue bridge. At the river crossings, instead of laying one 48-inch pipe it is proposed to lay two 36-inch pipes.

Nearly the whole length of this pipe in the public streets has been laid, or is included in existing contracts for laying pipes. The parts remaining to be done are the river crossings, for which contracts are being prepared, and comparatively short portions not in the public streets. At the Washington Street crossing of the Boston & Maine Railroad in Malden the work has not been begun, on account of a proposed reconstruction of the bridge over the railroad.

The only work done upon the second and more westerly line to Spot Pond is in Beacon Street, Brookline, where the two lines are laid side by side, and in Boylston Street, Cambridge, where it was desirable to lay 2,041 feet of pipe while the widening of the street was in progress. No work has been done on the branch to Everett and Chelsea, but this branch is not as essential as other parts of the work, as there are already pipes leading to these places.

CONTRACTS, LOW-SERVICE PIPE LINES.

The following statements give in detail the work done upon the several contracts for laying the low-service lines of 48-inch pipes.*

Section 2, — Curnan & Hochstadter, Contractors.

This section includes two lines of 48-inch pipes in Beacon Street, between Chestnut Hill Avenue in Brighton and Winchester Street in Brookline, and a single line of 48-inch pipes in Beacon and St. Paul streets in Brookline, and across private property in Boston, to a point near the Boston & Albany Railroad, a total length of about 20,000 feet. The work was begun May 11 and completed Oct. 3, 1896.

The conditions for doing work on this section were very favorable, as the trenches required but little bracing and the streets were wide, giving sufficient room for the disposal of material, and but few obstructions were encountered. The contractors prosecuted their work energetically, and executed it in a very satisfactory manner. At three points, where the pipes cross over or under equally large pipes of the Boston water works, brick piers and iron beams were provided to support the upper pipes.

Sections 4 and 11, — Snyder & Williams, Contractors.

Section 4 is a portion of the easterly line of 48-inch pipes leading from Chestnut Hill Reservoir to Spot Pond, and extends from a point near the Charles River in Cambridge, through Cambridge park land, Magazine Street, Massachusetts Avenue and Norfolk Street in Cambridge, and Webster Avenue, Union Square, Bow and Walnut streets in Somerville, to Broadway, a distance of about 16,104 feet.

* See also table on page 69.

Section 11 is on the westerly line of pipes, and the portion included in this contract extends from a point near the Charles River, through Boylston Street and Harvard Square to Massachusetts Avenue, a distance of 2,041 feet, making the total length of pipe to be laid under this contract 18,145 feet.

Work was begun on Section 11 on August 17. The material underlying the pipe on Boylston Street, from the beginning of the section near the river to Eliot Street, a distance of 850 feet, was found to be mud, requiring a pile foundation for the pipes. Piles were driven in bents of 2, and capped with 12-inch by 12-inch spruce timber. The bents were spaced about 6 feet apart, giving 4 piles under each length of 48-inch pipe. About 320 linear feet of the pipe on Section 4, near the foot of Magazine Street, were supported in the same manner.

The sewers in some portions of Cambridge and Somerville are so near the surface of the street that the pipes could not be laid without cutting off the drains connecting the houses on one side of the street with the sewer. In such cases it was found necessary to build an additional sewer, and the contractors have for this purpose laid 3,475 feet of sewer pipe, of sizes from 8 inches to 15 inches in diameter, and reconnected several house drains.

The streets on Section 4 are rather narrow, and are well filled with gas and water pipes, sewers, etc. In laying 9,593 feet of pipe on Section 4 it was found necessary to raise or lower 20 main pipes and 108 service pipes of the Cambridge water works, 14 main pipes and 31 service pipes of the gas company, and 31 house or surface water drains connecting with the sewers, also to relay in a new location 2,882 linear feet of main gas pipe.

The contract provided for the completion of this work December 1, but there still remain to be laid 6,511 feet of pipe in Somerville.

Where the 48-inch pipe crosses the Boston & Lowell Railroad at Walnut Street, Somerville, it is to be supported by a plate-girder bridge, a contract for which was made with the Boston Bridge Works on Oct. 3, 1896, and the bridge was to have been completed on December 1, but, as the works of the contractor were destroyed by fire, the bridge has not yet been furnished. As the pipe laying has not yet reached this point, it has not been affected by the delay in completing the bridge.

Section 6, — Dennis F. O'Connell, Contractor.

The part of this section included in the contract extends from a point just north of the Mystic River in Medford, through Middlesex Avenue in Medford and Highland Avenue and Medford Street in Malden, to Pearl Street, a distance of 6,800 feet. The work was begun September 2 and completed November 24. Piles were driven to support the pipe for a distance of about 350 feet. No serious difficulties were encountered in doing this work, although considerable water was found in the trench at some places.

Section 7, — The C. H. Eglee Company, Contractor.

Section 7 begins on Washington Street, Malden, at a point near Clifton Street, and extends through Washington Street in Malden and Melrose to the Stoneham town line; thence through Wyoming Street, Ravine Road and the Virginia Wood in Stoneham to Woodland Road. The total length is 11,592 feet. Work was begun June 17, and at the end of the working season the contractor had laid a continuous line of pipe from Woodland Road south-easterly to a point about 200 feet north of the Oak Grove station in Malden, a distance of 9,412 feet.

In addition to the 48-inch pipe line, the contract provided for the laying of 1,500 feet of the 36-inch northern high-service pipe line in the Middlesex Fells Parkway; but, owing to the difficulty in obtaining a right of way in this parkway and to delay in receiving from the foundry the thinner pipes required for this contract, it was modified so that the 36-inch pipe line could be omitted, and the contractor was to lay instead about 1,500 feet of thicker 48-inch pipes in Washington Street in Malden, between Pleasant and Kneeland streets. About 2,180 feet of 48-inch pipe remain to be laid to complete the contract. Between October 19 and November 2 arrangements were made with the contractor to lay about 290 feet of 48-inch pipe on Pleasant and Washington streets, Malden. The last-named work was done at the request of the Malden street commissioner, who desired to repave the street.

NORTHERN HIGH-SERVICE SYSTEM.

Water for this system is to be taken from Spot Pond, which, as already stated, is to serve as a distributing reservoir for the low-service system. The location of the pumping station has not yet

been definitely determined, but it will probably be on the easterly side of the pond near the present outlet. From the pumping station a 36-inch force main will convey the water to a distributing reservoir, containing about 40,000,000 gallons, to be located in the higher portion of the Middlesex Fells reservation. From this reservoir the water will be conveyed in a 36-inch pipe through the Fells, the Fells Parkway and Highland Avenue to Pleasant Street in Malden, where the pipe will branch in two directions, the westerly branch leading to Medford and Somerville, to supply the higher portions of those cities, and the easterly branch running through Malden, Everett, Chelsea and Revere to Breed's Island in Boston. Contracts have been made for a large part of the westerly and easterly branches above mentioned.

CONTRACTS, NORTHERN HIGH-SERVICE PIPE LINES

Section 14, — Collins & Ham, Contractors.

This section includes the 30-inch pipe line beginning at the corner of Highland Avenue and Pleasant Street in Malden, and extends easterly and south-easterly, through Pleasant, Main and Cross streets, to the corner of Hancock Street in Malden, a distance of 7,330 feet. The contract was dated Oct. 8, 1896, and the contractor began work October 21, but the progress made has been slow, and but 2,670 feet of the pipe, or about one-third of the total length, has thus far been laid.

There was considerable extra work to be done at the crossing of the Pleasant Street culvert on Spot Pond Brook, and the moving of a main water pipe of the city of Malden, in Pleasant Street, also contributed to delay the work.

Section 15, — J. H. McKnight, Contractor.

This section begins at the terminus of Section 14 in Hancock Street, Malden, runs thence through Hancock Street to Broadway in Everett, thence through High, Foster, Arlington and Nichols streets in Everett, Nichols Street, Washington Avenue and Fenno Street in Chelsea, and Fenno Street in Revere, to a point opposite the Revere Reservoir on Prospect Hill.

Work was begun June 22, 1896, and all except about 730 feet of pipe, which could not be laid on account of delay in receiving valves and special castings, was completed Sept. 1, 1896. The length of

pipe laid under this contract was 4,192 feet of pipe 24 inches in diameter and 9,013 feet of pipe 20 inches in diameter.

Section 16, — George Goodhue, Contractor.

This section is located in Fenno and Beach streets and Winthrop Avenue, Revere, and includes the laying of 10,000 linear feet of 16-inch pipe. Work was begun on October 14, and by the terms of the contract should have been completed on December 1, but there still remain about 860 feet of pipe to be laid.

Section 18, — Collins & Ham, Contractors.

Section 18 is a part of the westerly branch of the northern high-service system; it includes a 20-inch pipe, beginning at the corner of Elm Street and Highland Avenue in Malden, and extending through Elm and Pleasant streets in Malden, and Salem Street, Middlesex Fells Parkway, and Valley, Forest and High streets in Medford, to a point 600 feet west of Forest Street and north of the Mystic River; also from the corner of South Street and South Street Court in Medford, south of the Mystic River, through South, Walnut and Summer streets and College Avenue, to a point about 350 feet east of the southern division of the Boston & Maine Railroad. The total length of pipe is about 14,400 feet.

The contract was made on October 8, and work was begun on October 14 on Forest Street in Medford, near Medford Square. The work has been done in Forest, Valley and Salem streets in Medford, where a total length of 4,411 feet of pipe has been laid. The progress on this work has been slow, as about 10,040 feet remain to be laid in 1897.

Principal Items of Work done on Contracts for Pipe Laying, Dec. 15, 1896.

	Section 2, Curnan & Hochstadter.	Sections 4 and 11, Snyder & Williams.	Section 6, D. F. O'Connell.	Sections 7 and 13, the C.H. Eglee Company.	Section 14, Collins & Ham.	Section 15, J. H. McKnight.	Section 16, George Good- hue.	Section 18, Collins & Ham.	Totals.
48-inch pipe laid (feet),	20,354	11,634	6,666	11,182	-	-	-	-	49,836
30-inch pipe laid (feet),	-	-	-	-	2,670	-	-	-	2,670
24-inch pipe laid (feet),	-	12	-	-	-	4,192	-	-	4,204
20-inch pipe laid (feet),	-	-	-	-	-	9,013	-	4,411	13,424
16-inch pipe laid (feet),	-	-	-	-	-	-	9,188	-	9,188
Rock excavation (cubic yards),	1,212.0	-	0.8	1,304.6	-	68.5	6.1	47.6	2,639.6
Earth below grade (cubic yards),	453.0	264.0	183.7	196.8	35.9	50.9	55.1	7.13	1,246.5
Valve chambers built,	9	8	5	4	1	5	8	4	44
Concrete masonry (cubic yards),	50.0	96.0	12.1	-	4.7	-	-	0.5	163.3
Piles driven,	-	394	120	-	-	-	-	-	514
8-inch sewer pipe laid (feet),	-	1,086	-	-	-	-	-	-	1,086
10-inch sewer pipe laid (feet),	-	1,207	-	-	-	-	-	-	1,207
12-inch sewer pipe laid (feet),	144	1,150	-	-	-	-	-	-	1,294
15-inch sewer pipe laid (feet),	-	33	-	-	-	-	-	-	33
Sewer man-holes built,	2	18	-	-	-	-	-	-	20
Value of work done Dec. 15, 1896,	\$39,775 26	\$32,360 21	\$16,685 41	\$28,456 49*	\$4,951 67	\$10,575 66	\$4,492 82	\$3,487 11	\$140,784 63

* Includes the cost of laying 230 linear feet of 48-inch pipe by day labor.

SOUTHERN HIGH-SERVICE SYSTEM.

The southern high-service system is to be, as already stated, an extension of the present high-service system of the city of Boston. An additional pumping engine will be required at Chestnut Hill, and the plans of the existing pumping station were made with reference to its enlargement to accommodate one more pumping engine. Much work has been done toward obtaining this engine, which will have sufficient capacity to lift 30,000,000 gallons of water per day.

The pipe lines of the southern high-service system have not been finally determined upon as yet, and cannot well be until it is wholly settled whether the city of Quincy will enter the metropolitan water district. The lines shown upon Plan No. 5 are substantially those shown in the report of the State Board of Health upon a metropolitan water supply; but it is the intention, if Quincy enters the district early in the season, to make the plans definite, and to endeavor to lay the pipes during the coming season. The city of Newton does not require water from the metropolitan works at present, and the best method of supplying Watertown and Belmont has not yet been fully determined.

ENGINEERING.

Although the work of purchasing and laying pipes has occupied a large part of the time of the engineers of the distribution department, the reservoirs and pumping stations which are to be built have not been neglected, and much of the time of the engineering force has been spent on surveys, plans and estimates of these parts of the work.

During the winter of 1895-96 three engineering parties were engaged for about three weeks upon a survey of Spot Pond, and in making soundings to obtain the depth of water and mud. Contour plans of the pond, on a scale of 40 feet to an inch, have been plotted from these surveys as a basis for further studies of the question of the best method of improving the pond by raising or otherwise. A large number of additional soundings have been made by pushing down rods to obtain the depth of mud, and many pipe borings have been made at the sites of suggested dikes and dams.

Extended surveys, soundings, plans and estimates have been made for the purpose of locating pipe lines through, and a distributing res-

ervoir in the Middlesex Fells reservation, and for preparing these portions of the work to be let to contractors.

Surveys, plans, estimates and reports have been made in relation to the admission of Quincy into the metropolitan water district.

Studies have been made relative to the best location for the low-service pumping station which is to be built at Chestnut Hill Reservoir, and the comparative advantages of different types of pumping machinery have been considered.

For the purpose of obtaining information in relation to the cost of pumping engines, the engineer of the distribution department during the month of October visited most of the principal cities of the United States, and inspected the different types of pumping engines in use.

Plans have been made of the different forms of special castings used in pipe laying, and a schedule has been prepared showing the standard dimensions and weights of all pipes and special castings.

An important part of the work of this department is the accounting for the great quantities of pipe made, from the time they are accepted by the inspector at the foundry until they are laid in the ground under the supervision of the inspector of pipe laying.

OFFICE FORCE.

REUBEN SHIRREFFS, *Principal Office Assistant* ; MORRIS KNOWLES, *Office Assistant*.

Mr. Shirreffs is at the head of the designing and drafting force, and has been engaged much of the time upon the design of the Nashua Dam, and structures now building on the line of the Nashua Aqueduct. He has also done much work in the preparation of specifications, contract plans and other work usually done in the drafting department. The principal plans drawn are as follows:—

Completed drawings of the seven-arch stone aqueduct bridge across the Assabet River.

Contract drawings for ten sections of the Nashua Aqueduct.

Completed plans and working drawings of fourteen culverts under the Nashua Aqueduct and of the chamber at the end of the aqueduct.

Plans of changes in location of roads crossing the aqueduct in six places.

Many preliminary studies and plans have been made with reference to details of the Nashua Dam, and the best method of utilizing

the power to be available at the dam. Much time has also been spent upon plans of lands to be taken and other plans of property.

Mr. Knowles has charge of the miscellaneous work of the office, such as the procuring of supplies, the making of blue-prints and the filing of plans and records received from outside offices. He has also had charge of many studies and computations relating to the damages caused by the diversion of water, to the probable assessment of cities and towns in the metropolitan water district, and much similar work.

ACCIDENTS.

Serious accidents have occurred at three different times in the aqueduct tunnel, by which five men have been killed and two seriously injured. Two of these accidents were due to a premature explosion and to a fall of rock from the roof. There has been one fatal accident in connection with the construction of the bridge across the Assabet River, — one of the men fell from the coffer-dam into the mill pond and was drowned.

Three other fatal accidents have occurred in connection with the pipe systems, two of which were on Section 7 and one on Section 18, of the pipe laying. In one case, on Section 7, a man was killed by the caving in of the side of the trench, and in the other case a man's skull was fractured by being struck with a crowbar thrown by a slipping derrick leg. On Section 18 a teamster was killed by pipes, which, not being properly secured, rolled from the wagon.

The number of fatalities for the year is, therefore, nine, and the number of serious accidents which did not result fatally, two.

Appended to this report are tables of contracts, giving the amount of work done and other information, and a table of the rainfall upon the Nashua water-shed for the year 1896.

Respectfully submitted,

FREDERIC P. STEARNS,

Chief Engineer.

BOSTON, MASS., Dec. 31, 1896.

APPENDIX.

APPENDIX

CONTRACTS MADE AND PENDING

Contracts made by the City of Boston and assumed by the Metropolitan Water

	1. WORK.	2. Contractor.	3. Date of Con- tract.
1	Dam No. 5, Southborough, . . .	Moulton & O'Mahoney, Boston, Mass., .	July 27, 1893,
2	Section A, Reservoir No. 5, . . .	Auguste Saucier, South Framingham, Mass.	Aug. 27, 1894,
3	Section B, Reservoir No. 5, . . .	Moulton & O'Mahoney, Boston, Mass., .	June 12, 1895,
4	Section C, Reservoir No. 5, . . .	Malone & Strang, Boston, Mass., . . .	April 29, 1895,
5	Section D, Reservoir No. 5, . . .	Auguste Saucier, South Framingham, Mass.	June 25, 1895,
6	Section E, Reservoir No. 5, . . .	Charles Linehan, Cambridgeport, Mass.,	April 29, 1895,
7	Section F, Reservoir No. 5, . . .	Newell & Snowling, Uxbridge, Mass., .	April 29, 1895,
8	Section G, Reservoir No. 5, . . .	Charles Linehan, Cambridgeport, Mass.,	April 29, 1895,
9	Section H, Reservoir No. 5, . . .	Moulton & O'Mahoney, Boston, Mass., .	April 29, 1895,
10	Filter beds near Marlborough Junction,†	John Berry, Fayville, Mass., . . .	April 4, 1895,
11	20,000 feet of iron fence along roads, Reservoir No. 5.	Henry Parsons, Marlborough, Mass., .	July 17, 1895,

* The figures given in this column are the nearest approximations to the final amounts of these contracts which can be made at the present time.

† Contract completed.

No. 1.

DURING THE YEAR 1896.

Board Jan. 4, 1896, relating to Reservoir No. 5 of the Sudbury System.

4. Date for Completion of Contract.	5. Prices of Principal Items.	6. Approximate Amount of Contract.*	7. Value of Work done to Time of December Estimate.	
Nov. 1, 1896,	Earth excavation and disposal in embankment, \$0.24 per cu. yd.; rock excavation, \$1.07 per cu. yd.; concrete masonry, Am. cem. mortar, \$4.70 per cu. yd.; rubble stone masonry in mortar, \$5.50 per cu. yd.; facing stone masonry (range work), \$17.00 per cu. yd.	\$537,000 00	\$504,425 77	1
Dec. 1, 1894,	Earth excavation, \$0.19½ per cu. yd.; split stone masonry in mortar, \$7.00 per cu. yd.; riprap, \$1.20 per cu. yd.	60,000 00	35,046 25	2
Dec. 1, 1896,	Earth excavation, \$0.29 per cu. yd.; split stone masonry, \$9.00 per cu. yd.; riprap, \$1.00 per cu. yd.	76,000 00	73,990 48	3
Dec. 1, 1896,	Earth excavation, \$0.21 per cu. yd.; split stone masonry, \$10.00 per cu. yd.; riprap, \$0.75 per cu. yd.	94,000 00	89,024 02	4
Dec. 1, 1896,	Earth excavation, \$0.21 per cu. yd.; split stone masonry, \$9.00 per cu. yd.; riprap, \$1.20 per cu. yd.	78,000 00	77,255 52	5
Dec. 1, 1896,	Earth excavation, \$0.23 per cu. yd.,	53,000 00	52,636 36	6
Dec. 1, 1896,	Earth excavation, \$0.26 per cu. yd.,	51,000 00	50,698 64	7
Dec. 1, 1896,	Earth excavation, \$0.19 per cu. yd.,	29,000 00	28,383 08	8
Dec. 1, 1896,	Earth excavation, \$0.26 per cu. yd.,	47,000 00	44,649 80	9
Aug., 1895,	Earth excavation, \$0.23½ per cu. yd.,	11,903 54	11,903 54	10
- -	\$0.79½ per lin. ft.,	15,000 00	7,887 28	11
		\$1,051,903 54	\$975,900 74	

NOTE.—The value of the work done on these contracts by the city of Boston amounted to \$512,000, leaving about \$540,000 as the value of the work to be done by the Metropolitan Water Board, and about \$464,000 as the value of the work done by the Metropolitan Water Board during 1896.

CONTRACTS MADE AND PENDING DUR-

Contracts made by the Metropolitan Water Board

[EXPLANATION. — The amounts given in columns 4 and 5 are those determined when canvassing the amounts of the final estimates, those marked b are the amounts as determined by recent approximate cases there is work to be done in addition to that included in the canvass of bids, for which the prices are

1.	Num- ber of Con- tract.	2. WORK.	3. Num- ber of Bids.	AMOUNT OF BID.		6. Contractor.
				4. Next to Low- est.	5. Lowest.	
1	9	Section I, Reservoir No. 5,	7	\$74,100 00	\$65,455 00†	H. P. Nawn, Boston, Mass.
2	10	Section J, Reservoir No. 5,	7	42,000 00	40,320 00†	Moulton & O'Mahoney, Boston, Mass.
3	11	Section K, Reservoir No. 5,	7	49,210 00	45,600 00†	Blagen & Bush, Port- land, Ore., and Spring- field, Mass.
4	12	Section L, Reservoir No. 5,	10	79,233 50	74,845 50†	Moulton & O'Mahoney, Boston, Mass.
5	13	Section M, Reservoir No. 5,	9	107,675 00	105,850 00†	H. P. Nawn, Boston, Mass.
6	14	Section N, Reservoir No. 5,	8	55,825 00	52,900 00†	Thomas Nevins & Son, Orange, N. J.
7	15	Section O, Reservoir No. 5,	9	151,113 00	136,040 00†	Washburn & Washburn, New York, N. Y.
8	16	Section P, Reservoir No. 5,	10	79,110 00	77,645 00†	H. P. Nawn, Boston, Mass.
9	17	Section Q, Reservoir No. 5,	14	123,690 00†	115,010 00	Washburn & Washburn, New York, N. Y.
10	32*	Stone arch bridge under N. Y., N. H. & H. R.R., near Fayville, and widening railroad embankment.	6	37,762 00	32,956 00†	Holbrook, Cabot & Daly, Brockton, Mass.
11	36	Sluice gates and floor plates at Dam No. 5.	4	4,890 00	4,635 00†	R. D. Wood & Co., Phila- delphia, Pa.
12		Total, . . . . .		. . . . .	. . . . .	. . . . .

Contracts made by the Metropolitan Water

13	2	Section 2, Nashua Aque- duct, 4,300 lin. ft. in tun- nel.	19	\$133,338 00	\$122,398 00†	E. D. Smith & Co., Phila- delphia, Pa.
14	3	Section 3, Nashua Aque- duct, 6,017 lin. ft. in tun- nel, 1,000 lin. ft. in open trench.	18	265,062 50	248,428 00†	E. D. Smith & Co., Phila- delphia, Pa.

* Contract completed.
† Contract based upon this bid. In the case of Contract No. 17 the contract was awarded to the lowest bidder on a combination bid for sections O and Q.

ING THE YEAR 1896 — Continued.

relating to Reservoir No. 5 of the Sudbury System.

bids. The amounts given in column 11 are made up in three ways: those marked a are the exact estimates, and those marked c are the amounts as determined in making the canvass of bids. In some fixed in the contract.]

7.	8.	9.	10.	11.	12.	
Date of Contract.	Date for Completion of Contract.	Date of Final Estimate.	Prices of Principal Items.	Approximate Amount of Contract.	Value of Work done to Time of December Estimate.	
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.26½ per cu. yd.	\$65,455 00 c	\$47,711 40	1
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.24 per cu. yd.	40,820 00 c	37,498 56	2
May 8, '96,	Dec. 1, '97,	-	Earth excavation, \$0.30 per cu. yd.	45,600 00 c	28,877 40	3
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.24 per cu. yd.	74,845 50 c	38,182 40	4
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.29 per cu. yd.	105,850 00 c	27,245 50	5
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.86 per cu. yd.	52,200 00 c	46,707 84	6
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.28½ per cu. yd.	158,270 00 b	25,408 89	7
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.26½ per cu. yd.	77,645 00 c	42,858 72	8
April 27, '96,	Dec. 1, '97,	-	Earth excavation, \$0.28½ per cu. yd.	142,500 00 b	44,420 67	9
Aug. 17, '96,	Dec. 1, '96,	Dec. 15, '96,	Earth excavation, \$0.30 per cu. yd.; ashlar masonry, \$16.00 per cu. yd.; rubble stone masonry, \$5.00 per cu. yd.; voussoir masonry, \$22.00 per cu. yd.; riprap, \$1.25 per cu. yd.	33,400 21 a	33,400 21	10
Sept. 17, '96,	Dec. 15, '96,	-	- -	4,635 00 c	-	11
. . .	. . .	. . .	. . . . .	\$800,720 71	\$367,311 59	12

Board relating to the Nashua Aqueduct.

Feb. 14, '96,	Dec. 1, '97,	-	Large shaft excavation, \$40.00 per lin. ft.; small shaft excavation, \$25.00 per lin. ft.; tunnel excavation, \$3.35 per cu. yd.; brick masonry for lining, laid in mortar, 1 part Am. cem. to 1½ parts of sand, \$11.60 per cu. yd.	\$122,898 00 c	\$46,965 00	13
Feb. 14, '96,	Dec. 1, '97,	-	Large shaft excavation, \$40.00 per lin. ft.; earth excavation, \$0.50 per cu. yd.; tunnel excavation, \$3.35 per cu. yd.	248,428 00 c	67,395 00	14

CONTRACTS MADE AND PENDING DUR-
Contracts made by the Metropolitan Water

1. Num- ber of Con- tract.	2. WORK.	3. Num- ber of Bids.	AMOUNT OF BID.		6. Contractor.	
			4. Next to Low- est.	5. Lowest.		
1	19	Section 4, Nashua Aque- duct, 5,700 lin. ft. ma- sonry aqueduct.	16	\$106,107 50	\$104,733 90*	S. Casparis, Columbus, Ohio.
2	20	Section 5, Nashua Aque- duct, 5,300 lin. ft. ma- sonry aqueduct.	16	97,015 50	95,679 80*	S. Casparis, Columbus, Ohio.
3	21	Section 6, Nashua Aque- duct, 6,400 lin. ft. ma- sonry aqueduct.	16	124,325 50	123,775 90*	S. Casparis, Columbus, Ohio.
4	22	Section 7, Nashua Aque- duct, 5,543 lin. ft. ma- sonry aqueduct.	17	105,855 00*	105,565 00	S. Casparis, Columbus, Ohio.
5	23	Section 8, Nashua Aque- duct, Assabet bridge.	17	64,676 25*	59,897 00	Jones, Pollard & Co., Baltimore, Md.
6	24	Section 9, Nashua Aque- duct, 6,268 lin. ft. ma- sonry aqueduct.	14	146,567 50	144,185 00*	S. Casparis, Columbus, Ohio.
7	25	Section 10, Nashua Aque- duct, 6,290 lin. ft. ma- sonry aqueduct.	13	174,442 00	147,351 00*	S. Casparis, Columbus, Ohio.
8	37	Section 11, Nashua Aque- duct, open channel 15,800 feet in length, with two small masonry dams and several stone arch road bridges.	21	89,470 00*	86,960 00	Moulton & O'Mahoney, Boston, Mass.
9		Total, . . . . .		. . . . .	. . . . .	. . . . .

* Contract based upon this bid. In the case of Contract No. 23 the contract was awarded to the lowest bidder on a combination bid for sections 7, 9 and 10.

ING THE YEAR 1896 — *Continued.**Board relating to the Nashua Aqueduct — Concluded.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items.	11. Approximate Amount of Contract.	12. Value of Work done to Time of December Estimate.	
May 9, '96,	Nov. 15, '97,	-	Earth excavation, \$0.25 per cu. yd.; rock excavation, \$1.00 per cu. yd.; brick masonry in Am. cem. mortar, \$11.92 per cu. yd.; Am. cem. concrete, \$3.80 per cu. yd.; Portland cem. concrete, \$5.00 per cu. yd.	\$104,733 90 c	\$16,618 85	1
May 9, '96,	Nov. 15, '97,	-	Earth excavation, \$0.25 per cu. yd.; rock excavation, \$1.00 per cu. yd.; brick masonry in Am. cem. mortar, \$11.92 per cu. yd.; Am. cem. concrete, \$3.80 per cu. yd.; Portland cem. concrete, \$5.00 per cu. yd.	95,679 80 c	16,421 20	2
May 9, '96,	Nov. 15, '97,	-	Earth excavation, \$0.24 per cu. yd.; rock excavation, \$0.90 per cu. yd.; brick masonry in Am. cem. mortar, \$11.92 per cu. yd.; Am. cem. concrete, \$3.80 per cu. yd.; Portland cem. concrete, \$5.00 per cu. yd.	123,775 90 c	14,719 70	3
May 9, '96,	Nov. 15, '97,	-	Earth excavation, \$0.25 per cu. yd.; rock excavation, \$1.25 per cu. yd.; brick masonry in Am. cem. mortar, \$12.00 per cu. yd.; Am. cem. concrete, \$3.80 per cu. yd.; Portland cem. concrete, \$5.00 per cu. yd.	105,855 00 c	22,954 60	4
June 16, '96,	Nov. 1, '97,	-	Ashtar masonry, \$17.68 per cu. yd.; voussoir masonry, \$31.43 per cu. yd.; cut stone masonry, \$27.75 per cu. yd.; Portland cem. concrete, \$6.24 per cu. yd.; Am. cem. concrete, 5 parts stone, 2 parts sand, 1 part cem., \$4.19 per cu. yd.; Am. cem. concrete, 6 parts stone, 3 parts sand, 1 part cem., \$3.95 per cu. yd.	64,676 25 c	26,814 25	5
May 9, '96,	Nov. 15, '97,	-	Earth excavation, \$0.27 per cu. yd.; rock excavation, \$1.25 per cu. yd.; brick masonry, \$12.00 per cu. yd.; Am. cem. concrete, \$3.75 per cu. yd.; Portland cem. concrete, \$4.90 per cu. yd.	144,185 00 c	26,323 85	6
May 9, '96,	Nov. 15, '97,	-	Earth excavation, \$0.27 per cu. yd.; rock excavation, \$1.50 per cu. yd.; brick masonry, \$12.00 per cu. yd.; Am. cem. concrete, \$3.75 per cu. yd.; Portland cem. concrete, \$4.90 per cu. yd.	147,351 00 c	84,726 02	7
Sept. 22, '96,	Dec. 1, '97,	-	Earth excavation, \$0.18 per cu. yd.; Am. cem. concrete, \$5.00 per cu. yd.; split stone masonry and paving laid in mortar, \$18.00 per cu. yd.	89,470 00 c	4,382 58	8
.	.	.	.	\$1,246,552 85	\$327,320 55	9

CONTRACTS MADE AND PENDING DUR-
Contracts made by the Metropolitan Water
Water Pipes.

1.	Num- ber of Con- tract.	2. WORK.	3. Num- ber of Bids.	AMOUNT OF BID.		6. Contractor.
				4. Next to Low- est.	5. Lowest.	
1	1*	12,000 tons 48-inch cast-iron waterpipes; 500 tons special castings.	3	\$298,000 00	\$267,500 00†	R. D. Wood & Co., Phil- adelphia, Pa.
2	5*	5,550 tons cast-iron water pipes; 5,000 tons 48-inch, 550 tons 36-inch; and 50 tons special castings.	8	Pipe, \$20.00 per ton; special cast-ings, \$45.00 per ton.	Pipe, \$19.90 per ton; special cast-ings, \$45.00 per ton.†	McNeal Pipe & Foundry Co., Burlington, N. J.
3	6*	1,545 tons cast-iron water pipes; 520 tons 24-inch, 900 tons 20-inch, 50 tons 16-inch, 30 tons 12-inch, 20 tons 10-inch, 15 tons 8-inch, 10 tons 6 inch; and 60 tons special castings.	5	Pipe, \$20.00 per ton; special cast-ings, \$45.00 per ton.	Pipe, \$19.90 per ton; special cast-ings, \$45.00 per ton.†	McNeal Pipe & Foundry Co., Burlington, N. J.
4	7*	4,470 tons cast-iron water pipes; 3,870 tons 48-inch, 600 tons 36-inch.	†	†	†	Howard-Harrison Iron Co., Bessemer, Ala.
5	8	4,550 tons cast-iron water pipes; 4,000 tons 48-inch, 550 tons 36-inch.	†	†	†	Warren Foundry & Ma- chine Co., Phillips- burg, N. J.
6	34	3,300 tons cast-iron water pipes; 1,450 tons 30-inch, 1,570 tons 20-inch, 280 tons 16-inch.	4	30-in., \$18.70 per ton; 20 and 16 inch, \$18.90 per ton.	30-in., \$18.40 per ton; 20 and 16 inch, \$18.90 per ton.†	Warren Foundry & Ma- chine Co., Phillips- burg, N. J.
7	35*	150 tons special castings. .	3	\$40 00	\$39 50†	R. D. Wood & Co., Phil- adelphia, Pa.
8	38*	1,000 tons cast-iron water pipes; 900 tons 16-inch, 100 tons 12-inch.	3	\$18.40 per ton.	\$17.85 per ton.†	R. D. Wood & Co., Phil- adelphia, Pa.
9	43	3,550 tons cast-iron water pipes; 1,200 tons 48-inch, 2,350 tons 42-inch.	4	\$19.90 per ton.	48-in., \$18.75 per ton; 42-inch, \$19.25 per ton.†	Howard-Harrison Iron Co., Bessemer, Ala.
10	44	3,000 tons 48-inch cast-iron water pipes.	5	\$18.75 per ton.	\$18.40 per ton.†	Warren Foundry & Ma- chine Co., Phillips- burg, N. J.
11	45	3,150 tons 48-inch cast-iron water pipes.	†	†	†	McNeal Pipe & Foundry Co., Burlington, N. J.
12		Total for pipes, . . .	. . .	. . .	. . .	. . . . .

* Contract completed. † Contract based upon this bid.

ING THE YEAR 1896 — *Continued.*
Board relating to the Distributing System.

Water Pipes.

7.	8.	9.	10.	11.	12.	
Date of Contract.	Date for Completion of Contract.	Date of Final Estimate.	Prices of Principal Items.	Approximate Amount of Contract.	Value of Work done to Time of December Estimate.	
Dec. 27, '96,	Dec. 1, '96,	Dec. 28, '96,	Straight pipe, \$21.65 per ton of 2,000 pounds; special castings, \$21.65 per ton of 2,000 pounds, delivered at the pipe yards.	\$274,166 23a	\$274,166 23	1
Mar. 10, '96,	Dec. 1, '96,	Nov. 7, '96,	Straight pipe, \$19.90 per ton of 2,000 pounds; special castings, \$45.00 per ton of 2,000 pounds, delivered at the pipe yards.	114,889 47a	114,889 47	2
Mar. 10, '96,	Aug. 1, '96,	Nov. 7, '96,	Straight pipe, \$19.90 per ton of 2,000 pounds; special castings, \$45.00 per ton of 2,000 pounds, delivered at the pipe yards.	34,814 76a	34,814 76	3
Mar. 17, '96,	Dec. 1, '96,	Dec. 5, '96,	Straight pipe, \$19.90 per ton of 2,000 pounds, delivered at the pipe yards.	88,723 22a	88,723 22	4
Mar. 23, '96,	Dec. 15, '96,	-	Straight pipe, \$19.90 per ton of 2,000 pounds, delivered at the pipe yards.	90,545 00	85,052 60	5
Aug. 12, '96,	Nov. 15, '96,	-	30-inch pipe, \$18.40 per ton of 2,000 pounds; 20 and 16 inch pipe, \$18.90 per ton of 2,000 pounds, delivered at the pipe yards.	62,074 89b	61,846 88	6
Aug. 12, '96,	Nov. 15, '96,	Dec. 24, '96,	Special castings, \$39.50 per ton of 2,000 pounds, delivered at the pipe yards.	5,715 95a	5,715 95	7
Sept. 9, '96,	Dec. 15, '96,	Dec. 23, '96,	Straight pipe, \$17.85 per ton of 2,000 pounds, delivered at the pipe yards.	18,097 84a	18,097 84	8
Oct. 20, '96,	May 1, '97,	-	48-inch pipe, \$18.75 per ton of 2,000 pounds; 42-inch pipe, \$19.25 per ton of 2,000 pounds, delivered at the pipe yards.	67,737 50c	-	9
Oct. 22, '96,	May 1, '97,	-	Straight pipe, \$18.40 per ton of 2,000 pounds, delivered at the pipe yards.	55,200 00c	20,681 60	10
Oct. 20, '96,	May 1, '97,	-	Straight pipe, \$18.40 per ton of 2,000 pounds, delivered at the pipe yards.	57,960 00	22,944 80	11
.	.	.	.	\$869,424 86	\$726,433 85	12

† No bids were received on these contracts; they were made at the prices fixed by the bids for contracts Nos. 6 and 44.

CONTRACTS MADE AND PENDING DUR-
Contracts made by the Metropolitan Water
Pipe Laying.

1. Num- ber of Con- tract.	2. WORK.	3. Num- ber of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Low- est.	5. Lowest.	
1	18* Laying 20,000 lin. ft. of 48- inch pipes in Brookline and Brighton (Section 2).	21	\$37,502 25†	\$26,047 50	Curnan & Hochstadter, Poughkeepsie, N. Y.
2	29* Laying 4,400 lin. ft. of 24- inch and 9,700 feet of 20-inch water pipes in Malden, Everett, Chelsea and Revere (Section 15).	5	12,744 00	11,873 00†	J. H. McKnight, Pitts- burg, Pa.
3	30 Laying 11,500 lin. ft. of 48- inch and 1,500 feet of 36- inch water pipes in Mal- den, Melrose and Stone- ham (sections 7 and 13); also laying 1,500 feet of 48-inch water pipes under a modification of the con- tract.	4	27,838 20	27,718 50†	The C. H. Eglee Co., Boston, Mass.
4	31 Laying 18,300 lin. ft. of 48- inch water pipes in Cam- bridge and Somerville (sections 4 and 11).	6	42,581 90†	42,421 70	Snyder & Williams, Day- ton, Ohio.
5	33* Laying 6,800 lin. ft. of 48- inch water pipes in Med- ford and Malden (Section 6).	5	19,699 00	16,833 00†	Dennis F. O'Connell, Boston, Mass.
6	39 Laying 7,330 lin. ft. of 30- inch cast-iron water pipes in Malden (Section 14).	8	9,095 60	8,208 60†	Collins & Ham, South Boston, Mass.
7	41 Laying 10,000 lin. ft. of 16- inch cast-iron water pipes in Revere (Section 16).	11	5,441 50	4,723 00†	George Goodhue, Con- cord, N. H.
8	42 Laying 14,400 lin. ft. of 20- inch cast-iron water pipes in Malden and Medford (Section 18).	13	10,357 00	9,798 25†	Collins & Ham, South Boston, Mass.
9	Total for pipe laying, .	.	.	.	.

Miscellaneous.

10	4	20 36-inch water valves, .	10	\$9,400 00†	\$7,800 00	Josiah H. Long, Boston, Mass.
11	26*	25 sets of steel work for covering valve chambers.	4	1,575 00	1,066 00†	New Jersey Steel & Iron Co., Trenton, N. J.
12	27*	Cast-iron frames and cov- ers.	7	763 26	733 91†	Chelmsford Foundry Co., Boston, Mass.
13	28	52 water valves; 6 24-inch, 6 20-inch, 20 16-inch, 20 12-inch.	3	4,832 00	4,608 00†	Josiah H. Long, Boston, Mass.
14	40	Pipe bridge over Boston & Maine R.R. at Walnut Street, Somerville.	3	2,615 00	2,497 00†	Boston Bridge Works, Boston, Mass.
15		Total miscellaneous, .	.	.	.	.
16		Total for Distributing System, .	.	.	.	.

* Contract completed.

† Contract based upon this bid.

ING THE YEAR 1896 — *Continued.*
Board relating to the Distributing System — Concluded.

Pipe Laying.

7.	8.	9.	10.	11.	12.	
Date of Contract.	Date for Completion of Contract.	Date of Final Estimate.	Prices of Principal Items.	Approximate Amount of Contract.	Value of Work done to Time of December Estimate.	
April 27, '96,	Sept. 1, '96,	Oct. 13, '96,	Laying 48-inch pipe, \$1.73 per lin. ft.; rock excavation, \$1.50 per cu. yd.	\$39,775 26a	\$39,775 26	1
June 11, '96,	Sept. 15, '96,	Nov. 11, '96,	Laying 24-inch pipe, \$0.83 per lin. ft.; laying 20-inch pipe, \$0.73 per lin. ft.	10,575 66a	10,575 66	2
June 10, '96,	Nov. 1, '96,	-	Laying 48-inch pipe, \$1.92 per lin. ft.; rock excavation, \$3.00 per cu. yd.; laying 36-inch pipe, \$1.38 per lin. ft.; laying 48-inch pipe under modification of contract, \$2.42 per lin. ft.	30,000 00b	26,805 16	3
Aug. 6, '96,	Dec. 1, '96,	-	Laying 48-inch pipe, \$1.87 per lin. ft.; driving and capping piles, \$23.00 per bent.	44,600 00b	32,360 21	4
Aug. 27, '96,	Dec. 1, '96,	Dec. 24, '96,	Laying 48-inch pipe, \$2.24 per lin. ft.; driving and capping piles, \$12.00 per bent.	16,685 41a	16,685 41	5
Oct. 8, '96,	May 15, '97,	-	Laying 30-inch pipe, \$0.92 per lin. ft.	10,000 00b	4,951 67	6
Oct. 8, '96,	Dec. 1, '96,	-	Laying 16-inch pipe, \$0.45 per lin. ft.	4,900 00b	4,492 82	7
Oct. 8, '96,	May 15, '97,	-	Laying 20-inch pipe, \$0.62 per lin. ft.	10,300 00b	3,487 11	8
. . .	. . .	. . .	. . . . .	\$166,886 33	\$139,133 30	9

Miscellaneous.

Mar. 27, '96,	Dec. 12, '96,	-	\$470 per valve, . . .	\$9,400 00c	\$1,880 00	10
May 26, '96,	July 26, '96,	Aug. '19, 96,	\$42.64 per set, . . .	1,041 00a	1,041 00	11
May 18, '96,	July 18, '96,	Aug. 19, '96,	\$1.37½ per pound,. . .	733 59a	733 59	12
June 1, '96,	Nov. 1, '96,	-	24-inch valves, \$197.00; 20-inch, \$141.00; 16-inch, \$74.00; 12-inch, \$55.00.	4,608 00c	1,268 00	13
Oct. 8, '96,	Dec. 1, '96,	-	Price of bridge complete, \$2,497.	2,497 00c	-	14
. . .	. . .	. . .	. . . . .	\$18,279 59	\$4,922 59	15
. . .	. . .	. . .	. . . . .	\$1,054,540 78	\$870,489 24	16

CONTRACTS MADE AND PENDING DURING THE YEAR 1896 — *Concluded.*

Summary of Contracts.

	Approximate Amount of Contract.	Value of Work done to Date of December Estimate.
Reservoir No. 5, 11 contracts,	\$800,720 71	\$367,311 25
Nashua Aqueduct, 10 contracts,	1,246,552 85	327,320 55
Distributing System, 24 contracts,	1,054,540 78	870,489 24
Total of 45 contracts made by Metropolitan Water Board,	\$3,101,814 34	\$1,565,121 35
Reservoir No. 5, uncompleted portions of 11 contracts made by the city of Boston and assumed by the Metropolitan Water Board,	539,903 54	463,900 74
Total,	\$3,641,717 88	\$2,029,022 12

APPENDIX No. 2.

Monthly Rainfall, in Inches, during 1896, at Four Places on the Watershed of the Nashua River.

	LOCATION.			
	Princeton.	Quinepozet.	So. Clinton.	Sterling.
Elevation above mean sea level (feet),	1,060*	690*	310	560*
January,	1.96	1.69	2.12	1.63
February,	7.52	7.90	7.30	7.41
March,	5.76	5.50	4.44	6.22
April,	1.80	1.27	1.89	1.66
May,	2.37	2.81	2.45	2.25
June,	2.56	2.64	2.53	2.75
July,	5.10	4.78	4.83	4.23
August,	2.71	3.28	2.23	2.35
September,	6.94	7.00	7.60	7.69
October,	3.49	3.95	3.95	3.49
November,	2.83	3.24	2.98	2.91
December,	2.27	2.31	2.31	2.01
Totals,	45.31	46.37	44.63	44.51

* Elevations taken from maps of State topographical survey.

APPENDIX No. 3.

[Chapter 488 of the Acts of the Year 1895.]

AN ACT TO PROVIDE FOR A METROPOLITAN WATER SUPPLY.

Be it enacted, etc., as follows :

METROPOLITAN WATER BOARD.

SECTION 1. The governor, by and with the advice and consent of the council, shall appoint three water commissioners, who shall constitute the Metropolitan Water Board. Said commissioners shall hold office, one for the term of five years, one for the term of four years and one for the term of three years, beginning with the first Monday in May in the year eighteen hundred and ninety-five; and in the year eighteen hundred and ninety-eight, and annually thereafter, the governor shall appoint, as aforesaid, one member of said board to hold office for the term of three years, beginning with the first Monday in May in the year of his appointment. The governor, with the consent of the council, may remove any member of said board, and may appoint for the residue of the term, in the same manner in which the original appointment was made, a commissioner to fill any vacancy occurring by removal, resignation or otherwise. One of said commissioners shall be always a citizen of Boston, one shall be always a citizen of one of the other cities or towns in the water district hereinafter described, and one shall be always a citizen of this Commonwealth. The chairman of said board shall receive a salary of five thousand dollars a year, and the other members a salary of four thousand five hundred dollars a year.

Commissioners.
Terms of
service.Governor and
council may
remove.Residence of
commissioners.

Compensation.

OFFICERS AND ACCOUNTS.

SECTION 2. The governor shall, as soon as may be after the appointment of said board, and annually thereafter on or before the first Monday of May, designate one of their number to serve as chairman for the ensuing year; said board shall from time to time appoint an engineer, secretary, and such other

Governor to
designate
chairman.Board may
appoint and
remove officers
and agents.

Accounts.

Report to the legislature.

agents, officers, clerks and other employees as said board may deem necessary, shall determine the duties and compensation of such appointees, and may remove the same at pleasure, and may employ counsel; shall at all times keep full, accurate and separate accounts of the doings, receipts, expenditures, disbursements, assets and liabilities of said board, and include an abstract of the same in an annual report to the general court or or before the first Wednesday in January in each year, such report to be numbered as one of the series of public documents; and four thousand five hundred copies thereof to be printed annually.

METROPOLITAN WATER DISTRICT.

Board to construct and maintain water works.

Metropolitan water district.

To supply cities and towns within ten miles of state house.

May supply water companies in said district.

May supply other cities, towns and water companies.

Distribution of money.

Delivery of water.

SECTION 3. Said board, acting for the Commonwealth, shall construct, maintain and operate a system of metropolitan water works substantially in accordance with the plans and recommendations of the state board of health, contained in their report to the legislature of the year eighteen hundred and ninety-five, and shall provide thereby a sufficient supply of pure water for the following named cities and towns, and the inhabitants thereof, to wit:—The cities of Boston, Chelsea, Everett, Malden, Medford, Newton and Somerville, and the towns of Belmont, Hyde Park, Melrose, Revere, Watertown and Winthrop. which cities and towns shall constitute the Metropolitan Water District; shall secure and protect the purity of said water: shall on application furnish water to any city or town aforesaid that at the time of application owns its water pipe system: shall on application admit any other city or town, any part of which is within ten miles of the state house, into said water district, and furnish water to the same on the terms prescribed by this act for the cities and towns aforesaid, and on such payment of money as said board may determine; shall on application furnish water to any water company owning the water pipe system in any town within said ten miles, on such water company assuming the assessments of the town, if any, and making such payment of money as said board may determine; and may from time to time furnish water to any other city, town or water company, on such payment of money as said board may determine. All payments of money aforesaid shall be distributed to the cities and towns in said district in proportion to the total amount of the annual assessments theretofore paid by them respectively. Said board shall furnish said water to the city.

town or company, by delivering the same into a main water pipe, reservoir or tank of the city, town or company, under sufficient pressure for use without local pumping, unless delivered in some other manner by mutual agreement between the parties interested; and shall have the direction and control of the connections between the metropolitan and local systems. Said board may utilize the fall of water at any dam under their charge, and may thereby produce power or electricity, and may transmit such power or electricity by pipes, wires, or other suitable means, and sell the same, or the right to use such water, by written or other contract, to run for a term not exceeding fifteen years. Any person or corporation authorized by said board shall have all the powers relating to the production, sale and transmission of power and electricity given by this act to said board.

May transmit
and sell power
or electricity.

May authorize
persons and cor-
porations to sell
and transmit
power and elec-
tricity.

WATER SOURCES.

SECTION 4. Said board may take, by purchase or otherwise, the waters of the south branch of the Nashua river, at and above a point above the dam of the Lancaster Mills in the town of Clinton, but shall allow not less than twelve million gallons of water to flow from a reservoir above said dam in each week, and such further quantity, not exceeding twelve million gallons a week, as the owner of said mills shall from time to time certify to be necessary for use therein and in other buildings now or hereafter owned by him, for domestic or manufacturing purposes, other than the production of water power, and said board, in regulating the flow of said quantities, shall, as far as practicable, conform to any reasonable request in writing of the owner of said mills; said board may also take the waters of Sandy pond, so-called, in the town of Clinton, and the waters which may flow into and from said pond or river, and the tributaries thereof above said point; may take such water rights as they deem necessary connected with said waters; said board shall forthwith, after taking the waters of said Nashua river, take by purchase or otherwise all real estate which will be submerged or flooded, or submerged to an increased depth, by the construction of the proposed reservoir on the Nashua river hereinafter provided for, and all parcels of real estate above the dam of said reservoir used for mill purposes and owned by the owner of any mill property of which any part will be submerged or flooded by the construction of said reservoir, includ-

May take south
branch of
Nashua river.

To furnish
water for the use
of Lancaster
Mills.

To conform to
request of
owner of mills.

May take Sandy
pond.

To take real
estate
submerged or
flooded on
Nashua river,
and machinery
used on such
real estate.

To take lands,
ponds, etc.,
west of Chestnut
Hill reservoir.

To take
pumping station
at Chestnut Hill
reservoir and
land surround-
ing same.

To take Spot
pond and land
surrounding
same and
pumping
stations
thereon.

May take other
lands and
property.

To record
description of
land taken.

Ponds, lands,
etc., taken for
the Common-
wealth.

To record
description of
land entered
upon for use
and purposes
for which and
time to be used.

ing all the machinery used on such real estate and tenements for operatives ; shall, on or before the first day of January in the year eighteen hundred and ninety-eight, take all the lands and all the ponds, basins, reservoirs, filter beds, dams, aqueducts, conduits, pumping stations, pipes, pumps and other property held by the city of Boston for the purpose of supplying water or for the purpose of storing or of protecting or preserving the purity of the water, and situated westward of Chestnut Hill reservoir in said city and westward of the intersections of the main pipes to be laid from Chestnut Hill reservoir to Spot pond, with the main pipes which convey water from the Mystic distributing reservoir ; also the pumping station at Chestnut Hill reservoir and lands under and surrounding the same, and the pipes and aqueduct leading thereto ; also Spot pond, so-called, in or near the town of Stoneham, and the lands under and surrounding the same, now owned by the cities of Malden and Medford and the town of Melrose, or either of them, held for the purpose of water supply or of protecting or preserving the purity of the water, and the pumping stations and pumps thereon ; any or all of the aforesaid lands to be taken in fee or otherwise, as said board may determine. Said board may take any other lands in fee, easements, rights and other property that said board may deem necessary or desirable for carrying out the powers and duties conferred upon them by this act.

RECORD OF TAKING.

SECTION 5. Said board, to take any property by right of eminent domain, shall sign and cause to be recorded in the registry of deeds for the county and district in which the property to be taken is situated, a statement containing a description thereof, as certain as is required in a common conveyance of land, and stating that the same is taken for the metropolitan water works ; and upon such recording the ponds, works, lands, waters, easements, rights and other property described in said description shall be taken for the Commonwealth. Said board, upon entering upon any land for the purpose of using the same for carrying out any of the purposes of this act, shall sign and cause to be recorded in the registry aforesaid a statement containing a general description of the land and the purposes for which it is to be used, and the probable time for which the same is to be used, and after they have taken any property under the

right of eminent domain shall notify the owner thereof, and on the request of the owner within three years after such taking shall, within thirty days after such request, furnish him with a plan or description in writing, of his land or other property so taken.

To notify owner of taking by eminent domain.
To furnish plan, etc., to owner on request.

RESERVOIRS.

SECTION 6. Said board shall forthwith, after taking the waters of said Nashua river, construct a storage reservoir upon said Nashua river above said dam of the Lancaster Mills; shall forthwith construct the reservoir in Southborough already partially constructed by the city of Boston, and the dams thereof, and assume and carry out the agreement made by said city with the town of Southborough, and all contracts made by said city relating to the building of said reservoir; may construct other reservoirs, and may raise the level of any pond or reservoir under their charge. Said board may, as they deem desirable in constructing, or raising the level of, any pond or reservoir, raise or alter or discontinue parts of any railroad or public ways, and in case of a railroad shall make such raisings or alterations of the railroad, or construct upon existing or other locations, parts of the railroad to take the place of the parts so discontinued, as, and in such manner as, shall be mutually agreed upon by said water board and the board of directors of the railroad company; and if they cannot agree thereon then as, and in such manner as, shall be determined on the application of either party, in writing, by the board of railroad commissioners of this Commonwealth, who are hereby authorized and directed to adjudicate finally upon the same; and if said water board shall be of the opinion that the making of any such change of grade, alteration or construction requires that lands be taken therefor, said board shall, in the name of the Commonwealth, take such lands and convey the same to the railroad company to be thereafter held and used as the board of directors of such company may determine, and the railroad company may if it desires locate its lines over any lands so conveyed to it, and when said new lines of railroad are completed the railroad company may discontinue the operation of the portions of its existing lines for which the new lines are substituted, and may maintain and operate said new lines of railroad; and said water board shall build the dam of any pond or reservoir constructed, or whose level is raised, as aforesaid, and

Reservoir above dam at Lancaster Mills.

Shall construct reservoir at Southborough and carry out agreements.

May construct other reservoirs.

May alter or discontinue parts of railroads or ways.

Railroad to be constructed as agreed upon.

If cannot agree, application to be made to railroad commissioners.

Railroad commissioners' adjudication to be final.

May take lands and convey same to railroad company.

Railroad company may discontinue portions of existing lines and maintain and operate new lines.

Shall build ways in place of those discontinued. make the raisings or alterations of the public ways as aforesaid, and build in place of the parts of public ways discontinued, as aforesaid, such other reasonable and suitable ways, which shall thereafter be highways, as, and in such manner as, shall be mutually agreed upon by said water board and the county commissioners of the county in which such dam is to be built; or if they cannot agree thereon then as, and in such manner as, shall be determined on the application of said board, in writing, by the highway commission of this Commonwealth, which commission is hereby authorized and directed to adjudicate finally upon the same. Said water board, in flooding or otherwise affecting any burial ground, shall conform to any reasonable requirements relating thereto of the board of health of the city or town in which the same is situated.

Ways to be agreed upon by board and county commissioners.

If cannot agree, application to be made to highway commission.

To conform to requirements of boards of health in flooding burial grounds.

CHESTNUT HILL RESERVOIR.

To connect pumping station at Chestnut Hill reservoir with main water pipes.

Contracts of Boston with Somerville, Chelsea and Everett shall be cancelled.

To connect Nashua river with reservoir at Southborough.

SECTION 7. Said water board shall forthwith lay pipes to connect the pumping station at Chestnut Hill reservoir with the main water pipes through which water is now supplied to the cities of Somerville, Chelsea and Everett, and the Charlestown district of the city of Boston, and with Spot pond, and on the first day of January in the year eighteen hundred and ninety-eight the contracts of the city of Boston with the cities of Somerville, Chelsea and Everett, described in, and confirmed by, chapter three hundred and fifty-one of the acts of the year eighteen hundred and eighty-six, for a supply of water, shall be cancelled. Said board shall also forthwith, after taking the waters of Nashua river as aforesaid, connect said river with the tributaries of said reservoir in Southborough.

DELIVERY OF WATER TO LANCASTER MILLS.

At least 1,000,000 gallons of water to be delivered each week day.

To conform to request in writing of owner of mills.

SECTION 8. Said board, until they shall have completed the dam of said proposed reservoir on the Nashua river, and rebuilt the dam of said Lancaster Mills, shall, unless otherwise agreed by said board and the owner of said mills, deliver each week day at, and at the level of, the present top of the dam of said mills at least one million gallons of the water of said river, unpolluted by any acts or doings of said board, conforming in the delivery of said quantity, so far as practicable, to any reasonable request in writing of the owner of said mills.

CONSTRUCTION OF BUILDINGS, ROADS, ETC.

SECTION 9. Said board in carrying out the powers and duties hereinbefore conferred upon them may construct and maintain buildings, machinery, roads, conduits and aqueducts; may lay and maintain pipes, drains and wires; may alter or change the grades or directions of any water course; may carry and conduct any aqueduct, conduit, pipe, drain or wire under or over any water course, or any railroad, street or other way, in such a manner as not unnecessarily to obstruct or impede travel thereon; may dig up any such road, street or way, and lay, maintain and repair aqueducts, conduits, pipes, wires and other works beneath the surface thereof, conforming to any reasonable regulations made by the mayor and aldermen of cities and the selectmen of towns, respectively, wherein such works are performed, and restoring, so far as practicable, any such road, street or way, to as good order and condition as the same was in when such digging was commenced; said board may enter upon and use the lands of others; may take down dams to such an extent as they may deem necessary for prosecuting their works, and shall rebuild such dams whenever the necessity for keeping them down ceases; shall use such lands and do all work relating to such dams, in a reasonable manner with regard to the interests of the owners thereof, and, so far as practicable, shall heed all reasonable requests made by such owners; and in general may do any other act or thing necessary or proper for carrying out the powers and duties conferred upon them by this act.

May construct and maintain buildings, and lay and maintain pipes, etc.

May carry aqueduct, etc., over water courses, railroads, streets or ways.

May dig up roads, and lay pipes beneath surface conforming to regulations of aldermen and selectmen.

To restore roads after digging up same.

May use lands of others.

May take down and rebuild dams.

To heed requests made by owners of lands and dams.

In general to do all things necessary.

OPERATION OF WORKS TAKEN FROM BOSTON.

SECTION 10. Said board, on or before the first day of January in the year eighteen hundred and ninety-eight, shall commence the operation of the works taken by them from the city of Boston, and shall thereafter keep the same and all water works constructed by them, and all bridges which they may build across said reservoir upon the Nashua river, and (until they abandon the same by notice in writing to said city) said Chestnut Hill reservoir, safe, and shall have charge of, use, maintain and operate the same, and the Commonwealth shall exclusively be responsible for all damages caused thereby or by any defect or want of repair therein; said board shall have

To commence operation on or before January 1, 1898.

To keep works and reservoirs safe and have charge of same.

Commonwealth responsible for damages.

To have exclusive control of ponds and reservoirs.

May inspect works and fixtures in cities and towns supplied by board. May determine amount of water used and wasted.

the exclusive right and control over all ponds and reservoirs used by them in supplying water, and may order all persons to keep from entering in, upon or over, the waters thereof and the lands of the Commonwealth, city or town, surrounding the same; may inspect the water works and fixtures in any city or town supplied wholly or in part from the works under their charge, and may take all proper measures to determine the amount of water used and wasted and to prevent the improper use or waste of water.

PURCHASE AND SALE OF PROPERTY.

Storing, pumping or furnishing water.

City, town or company may sell and board purchase property.

Board may sell and lease property.

Proceeds paid into treasury of the Commonwealth.

SECTION 11. Said board and any city, town or water company aforesaid, may agree with each other for the storing or pumping of water, or the furnishing of the same as aforesaid by either party to any city, town or company; and any such city, town or company may sell to said board, and said board may purchase any property of such city, town or company, whether taken by eminent domain or otherwise, that said board may deem desirable for use in furnishing, as aforesaid, water to any city, town or water company; and said board may sell at public or private sale any property, real or personal, whether taken by eminent domain or otherwise, no longer needed for the water works under their charge, or may from time to time lease any property not then so needed. The proceeds from the operations of said board shall be paid into the treasury of the Commonwealth.

EXPENSES AND DAMAGES.

Board shall incur expense.

May agree upon amount of damages.

Damages of town of Clinton.

Damages of persons or corporations by taking of property, change of grade, etc.

SECTION 12. Said board shall incur such expenses as they deem necessary in constructing, operating and maintaining the water works under their charge; may agree with the party injured, upon the damages sustained by any city or town by the taking or use of its lands, ponds, reservoirs, water sources, aqueducts or other property, or the cancellation of contracts, as aforesaid; the damages sustained by the town of Clinton by any interference with its sewerage system or with its drainage rights or privileges; the damages sustained by any person or railroad or other corporation in property by any taking of property or by any change of grade, alteration or discontinuance of any railroad or public way, or by the construction or maintenance of any reservoir or other work, or by the interference with the use of any water, or by any other act or thing

done by said board under this act; shall save harmless the several cities and towns within which any road, street or way is dug up as aforesaid, against all damages for injuries resulting from a defect or want of repair in any road, street or way, caused by such digging up, or by constructing, laying, maintaining or repairing any aqueduct, conduit, pipe, wire or other works therein, and shall furnish without charge to all towns within which any work is done under authority of this act such additional police protection as may be necessary in consequence thereof: *provided*, said board shall have due and reasonable notice of the claims for such damages and opportunity to make a legal defence thereto.

Shall save cities and towns harmless against damages resulting from defect in ways caused by digging up same or laying pipes, etc., thereon.

Shall furnish police protection to towns.

Provided.

Board to have notice of claims and opportunity to defend same.

PETITION FOR JURY.

SECTION 18. Said board, city, town, person or corporation, if they cannot agree upon any damages, sustained as aforesaid, may, except in the cases in which payment is otherwise provided for in this act, within two years after the day of the taking of any land, water, easements or other property, or of the use of any property, or of the making of any change of grade, alteration, discontinuance, or location of a way or railroad, or of the doing of any other act or thing causing the damage, file in the office of the clerk of the superior court for the county in which the property taken, used or affected in value by such taking or other act of said board is situated, a petition, signed by the petitioner or the attorney of the petitioner, for a jury to determine such damages, and thereupon, after such notice as said court shall order, the damages so sustained shall be determined by a jury in said court, in the same manner as damages for lands taken for highways are determined. In determining any damages caused by any change of grade or discontinuance of a public way or railroad, or the substitution of a part of a public way or railroad for another part, there shall be taken into account any benefit to the party injured received from this act and anything done thereunder. Interest shall be included in such damages from the date of the taking, or the doing of the act or thing causing the damages, and costs shall be taxed and execution issued as in civil cases, against the Commonwealth in case the petitioner prevails, and against the petitioner in case he does not prevail. Damages for the temporary use of or injury to property may, on the request of the

If cannot agree upon amount of damages, jury may be had if applied for within two years.

Application to be filed in office of clerk of superior court.

After notice, damages to be determined by jury.

Benefit to be taken into account in determining damages.

Interest shall be allowed from date of taking, etc., and costs to be taxed.

Damages for temporary use may be assessed

by monthly payments.

petitioner, be assessed by monthly payments, to be continued so long as the property is used.

COMMISSIONS MAY BE APPOINTED TO DETERMINE DAMAGES.

Board may agree with owners of certain real estate not owned, April 1, 1895, by the owner of the Lancaster Mills, as to damages, etc.

If they cannot agree, petition may be brought within two years in supreme judicial court for county of Worcester.

After notice and hearing court to appoint commission of three persons.

Court may fill vacancies in commissions.

Commissions shall determine damages, specified in petitions.

SECTION 14. Said board, upon the application of the owner of any real estate taken for said proposed reservoir upon the Nashua river, or the owner of any real estate entered upon and used, or of any real estate injured by the taking of the waters of said Nashua river, whether said real estate is within or without the Commonwealth, or of any real estate not taken but directly or indirectly decreased in value by this act or the doings of said board thereunder, situated in the town of West Boylston or in that part of the town of Boylston on the northerly side of said proposed reservoir, or in that part of the town of Clinton on either side of River or Grove streets, between the dam of said proposed reservoir and a line drawn from the northerly corner of Oak and Boylston streets to the northerly corner of said Grove and Nashua streets, and not owned on the first day of April in the year eighteen hundred and ninety-five, by the owner of the Lancaster Mills, may agree with such owner upon the damages to be paid for such taking, injury or decrease in value, and if said board and the owner of any such real estate cannot agree upon such damages, such owner may, within two years after the first taking of water, or of land for said reservoir, under the right of eminent domain, file in the clerk's office of the supreme judicial court for the county of Worcester, in term time or vacation, a petition for the determination of such damages, and thereupon said court, after notice by publication in some newspaper published in the county of Worcester, and in such other manner as the court may order, that all persons entitled to file such petitions will be heard by said court on a day therein named, and a hearing thereon; shall from time to time appoint one or more commissions, each consisting of three disinterested persons, and may after notice and hearing fill any vacancy occurring in any such commission until all petitions referred to it have been heard and determined. Each of said commissions shall, after notice and hearing, determine the damages specified in all such petitions as may be filed as aforesaid and referred to it by said court; and if the owner of any such real estate, no part of

which is taken but which is decreased in value, shall in the petition aforesaid signify his willingness to surrender the real estate, or if there is a mill thereon, the real estate and machinery thereon, to the Commonwealth, the commission shall also determine the value of such real estate, or real estate and machinery, and interest may be included in such damages and in such value at such rate and for such time as the commission may deem just and equitable. Said commissions shall determine the damage to and value of real estate, machinery and business, and from time to time report their determinations on the petitions of such owners to said court. In case any individual or firm owning on the first day of April in the year eighteen hundred and ninety-five an established business on land in the town of West Boylston, whether the same shall be taken or not under this act, or the heirs or personal representatives of such individual or firm, shall deem that such business is decreased in value by the carrying out of this act, whether by loss of custom or otherwise, and unable to agree with said board as to the amount of damages to be paid for such injury, such damages shall be determined and paid in the manner hereinbefore provided. The words "real estate" as used in this section shall include water rights, and in the case of mills all machinery thereon.

Interest may be included in damages.

Commissions to report to said court.

Established business in West Boylston if decreased in value shall have damages determined.

Real estate to include water rights and machinery.

PAYMENT OF DAMAGES.

SECTION 15. Said board shall, upon agreeing upon any damages, or upon the acceptance by said court of any determination specified in the preceding section, notify the owner that they will pay the damages, or, in case the petitioner offers to make surrender, if they so prefer, they will pay the value so agreed upon or determined, and if any such owner shall in accordance with such notice and within one year after being so notified, deliver a release of such damages or a deed of the real estate, to and satisfactory to, said water board, said water board shall certify to the treasurer of the Commonwealth the amount to be paid such owner, and said treasurer shall pay the same from the proceeds of the bonds hereinafter provided for. Said water board, or any persons whose property is taken under the right of eminent domain, or entered upon or injured by the taking of said water, if dissatisfied with any determination of damages made by any commission, may at the term on

Board to notify owner that they will pay damages or value agreed upon or determined.

If owner releases damages or gives deed within one year he shall be paid from treasury of Commonwealth.

If board or owner dissatisfied with award of commission, may claim trial by jury.

which such determination is filed in court, or at the succeeding term, claim a trial by jury to determine such damages, and thereupon the damages shall be determined by a jury in said supreme judicial court as provided in section thirteen of this act.

PAYMENT TO CITY OF BOSTON AND TOWNS OF BOYLSTON AND WEST BOYLSTON.

Boston to be reimbursed for moneys paid in connection with basins not yet built.

Boylston to be paid \$2,000 a year.

West Boylston to be paid \$12,000 a year.

No tax or other payment to be made.

SECTION 16. The treasurer of the Commonwealth shall, from the proceeds of the bonds hereinafter provided for, reimburse the city of Boston for all moneys paid or that may hereafter be paid by said city for land damages, or otherwise, in connection with the location, building or maintenance of reservoirs or basins not yet built, or for lands taken for the preservation or protection of the purity of the waters of any reservoirs, or basins or of the tributaries thereof, and shall pay as part of the expenses of said metropolitan water works to the town of Boylston the sum of two thousand dollars a year and to the town of West Boylston the sum of twelve thousand dollars a year for the year of and each year succeeding said taking of the waters of said Nashua river, so long as each of said towns remains a municipality, and shall pay no tax or other payment to either of said towns on account of any property held by said water board for the purposes of a water supply.

METROPOLITAN WATER LOAN.

Negotiable bonds to be issued not exceeding \$27,000,000.

Principal and interest payable in gold coin.

Payable in not less than thirty nor more than forty years from date.

Interest not to exceed four per cent.

SECTION 17. The treasurer and receiver general shall, from time to time, on the request of said board, issue negotiable bonds in the name and behalf of the Commonwealth, and under its seal, to an amount not exceeding twenty-seven million dollars, designated on the face thereof, Metropolitan Water Loan. Said bonds shall be deemed a pledge of the faith and credit of the Commonwealth, shall be countersigned by the governor; shall have the principal and interest made payable thereon, in gold coin of the United States of America or its equivalent; shall bear interest payable semi-annually on the first days of January and July of each year; shall be registered, or with interest coupons attached; shall be payable within such terms not less than thirty nor more than forty years, and shall bear such rates of interest not exceeding four per cent. per annum, and be issued and disposed of in such amounts and in such modes and at such times and prices as the treasurer and receiver general, with the approval of the governor, shall from

time to time determine. Said treasurer shall, on issuing any of said bonds, establish a sinking fund and determine the amount to be paid thereto each year, sufficient with its accumulations to extinguish the debt at maturity.

Sinking fund to be established.

PROCEEDS FROM SALES OF PROPERTY AND BONDS.

SECTION 18. Said treasurer shall apply the proceeds from the sales of property made as hereinbefore provided, and the proceeds from the sales of said bonds, exclusive of the amounts received from premiums, to the payments for the property taken by said board, the payment of the damages aforesaid, and the payment of the expenses of construction of said water works, and the other payments specified in this act, and shall apply any premiums received from sales of said bonds, any assessments hereinafter provided for paid by the cities and towns, and the proceeds from the operations of said board, exclusive of the proceeds from sales of property, to the payment of the interest, sinking fund requirements and expenses of maintenance and operation of said water works, and shall take the balance required for said payments, if any, from the proceeds of said bonds, and shall apply the surplus, if any, to the payment of said interest, sinking fund requirements and expenses, for the following year. Said treasurer shall advance to such person as shall have been designated by said water board and shall have given a bond with sufficient sureties, to be approved by the auditor of the Commonwealth, in the sum of ten thousand dollars, such sums, not exceeding ten thousand dollars at any time, as said auditor may certify to be necessary to enable said board to make direct payment upon the pay rolls and other accounts of said board, and such persons shall, as soon as may be after expending any sum so advanced, and in all cases within thirty days from the receipt of any such sum, file with the auditor a statement in detail of the moneys expended subsequent to the last previous accounting, approved by said water board, and where it is practicable to obtain them, also file receipts or other like vouchers of the persons to whom the payments have been made.

Application of proceeds from sales of property and bonds.

Applications of amounts received from premiums and assessments.

Application of surplus.

\$10,000 to be advanced to person designated by board.

Detailed statement of moneys expended to be filed, also receipts and vouchers of persons receiving same.

ESTIMATE AND APPORTIONMENT OF ANNUAL EXPENSES.

SECTION 19. Said treasurer shall in each year estimate the amount, in addition to the premiums from sales of said bonds and the proceeds from the operations of said board, exclusive

Treasurer to estimate annually amount required for

maintenance,
interest, etc.,
and apportion
same in propor-
tion to valuation
and population.

One sixth only
of valuation and
population in
certain cities
and towns.

Cities and
towns assessed
upon full
valuation and
population
furnishing part
of water supply
to be allowed
certain sums.

First apportion-
ment to be
made in 1898.

Cities and
towns to be
notified of
assessments.

To be paid as
part of state tax.

of the proceeds from sales of property, required during the year to pay the interest, sinking fund requirements, expenses of maintenance and operation of said water works, and shall apportion to the city of Boston the proportion of such amount that the valuation of said city for the preceding year bears to the total of all such valuations of all cities and towns in said water district: *provided, however*, there shall be included only one sixth of the total valuation of any such city and town which has not reached the safe capacity of its present sources of supply in a dry year, as determined by said water board and certified to said treasurer, and has not made application to said board for water, and the remainder to the other cities and towns in said district, one third in proportion to their respective valuations and the remaining two thirds in proportion to their respective populations, including however only one sixth of the total valuation and one sixth of the total population of any such city and town which has not reached the safe capacity of its sources or of the sources of supply of the water company by which a town is supplied, or has not made application for water as aforesaid; and *provided, further*, that any city or town assessed upon its full valuation and population, which furnishes a part of its water supply from its own works or receives a supply from a water company, shall be allowed and credited in its apportionment with a sum equal to twelve dollars for each million gallons of water furnished as aforesaid, as determined by said water board and certified to said treasurer, and *provided, further*, that no such amount shall be so apportioned until the year eighteen hundred and ninety-eight, and in said year only the amount of three hundred thousand dollars shall be apportioned, and the sums of money expended by the state board of health under chapter four hundred and fifty-nine of the acts of the year eighteen hundred and ninety-three and chapter four of the resolves of the year eighteen hundred and ninety-five, and in the succeeding years the said amount of three hundred thousand dollars and two hundred thousand dollars additional for each year thereafter shall be so apportioned until the entire amount required as aforesaid is reached, and thereafter such entire amount shall be so apportioned. Said treasurer shall in each year notify each city and town of the amount of its assessment, and the same shall be paid by the city or town into the treasury of the Commonwealth at the time required for the payment and as part of its state tax.

CONTROL AND DISTRIBUTION OF WATER.

SECTION 20. The water board, water commissioners or superintendent of any city or town in the metropolitan water district, shall for their respective cities or towns, on and after the first day of January in the year eighteen hundred and ninety-five, have the charge and control of the water sources, water and water works owned and used by said city or town and not taken or used by said metropolitan water board as herein provided. Said water board, water commissioners or superintendent shall distribute and control the use of the water so furnished, and apply meters and extend the pipes and other work as said water board, water commissioners or superintendent may deem expedient; shall keep the pipes, fixtures and other works under their charge in good condition and repair, but shall not expend in any year more than the amount appropriated by the city or town therefor. Said water board, water commissioners or superintendent, with the approval of the mayor or selectmen, shall determine the rate to be paid for water by the owner of the premises to which the water is furnished; or by the person or persons using the water: *provided, however,* that the minimum rates to be paid for water, and the premises to which the high service supply shall be furnished, shall be subject to the approval of said metropolitan water board. Any water board, water commissioner or superintendent as aforesaid shall for the water works under his charge do all the acts and things relating to buildings, machinery, roads, conduits, aqueducts, pipes and drains, which said metropolitan water board is authorized to do for the water works under their charge, and may take lands therefor, in fee or otherwise, and shall do all such acts and things and make all such takings in the manner in which said metropolitan water board are authorized to do similar things, and the damages sustained shall be recovered of, and paid by, the city or town for which such water board, water commissioners or superintendents are appointed or elected, in the same manner as damages caused by similar acts of said metropolitan water board are recovered of, and paid by, the Commonwealth.

Water boards, etc., of cities and towns to have charge of works not taken by board.

Not to exceed appropriations by city or town.

Water rates to be determined.

Board to approve rates.

Water boards, etc., of cities and towns to do all things relating to water supply.

Damages shall be paid by city or town.

APPLICATION OF INCOME.

SECTION 21. The income received in each city or town from the water works under the charge of its water board, water

Cities and towns to apply income to

payment of
expenses,
interest, etc.

Balance as city
or town may
determine.

If income is
insufficient
balance to be
raised by
taxation or
loan.

commissioners or superintendent, shall be applied to the payment of the expenses of maintenance and operation incurred by said water board, water commissioners or superintendent; the interest and sinking fund requirements of all bonds, notes or scrip of the city or town issued on account of the water works of such city or town; the assessment of the city or town to be paid to the treasurer of the Commonwealth as hereinbefore provided; the expenses of the extension of the works; and the balance, if any, as the city or town may determine. If such income in any year shall not be sufficient for said payments the balance required therefor shall be raised by taxation or by loan, as the city or town may determine; and the city or town is hereby authorized to assess such taxes and make such loans without further authority from the legislature.

WORCESTER AND CERTAIN TOWNS MAY TAKE WATER.

City of
Worcester and
certain towns
may take water
from Nashua
river under
certain con-
ditions.

If water is
taken, propor-
tion of cost to
be paid to the
Common-
wealth.

If cannot agree
on amount,
master to be
appointed.

SECTION 22. The towns of Clinton, Sterling, Boylston, West Boylston, Lancaster, Holden, Rutland, Princeton, Paxton and Leicester, and the city of Worcester, may take from the south branch of the Nashua river, above the dam of the proposed reservoir on said river, so much of the water thereof as they have already been or may hereafter be authorized by the legislature to take, for supplying their inhabitants with water, and in case either of the towns of Lancaster, Holden, Rutland, Princeton, Paxton or Leicester, or the city of Worcester, shall so take water, it shall pay to the Commonwealth, to be paid into the sinking funds for said bonds, a fair proportion of the cost incurred by the Commonwealth for said water and for the construction, maintenance and operation of said works, the same to be determined by the engineer of said board and an engineer to be appointed by the city or town, and if they cannot agree, the proportion shall be determined by a master to be appointed by the supreme judicial court on the petition of either party interested, and the report of such master made and accepted by said court shall be final and binding on all parties:

USE OF WATER IN DISTRICT RESTRICTED.

No city or town
in district to use
water for
domestic
purposes except

SECTION 23. No city or town, any part of which is within ten miles of the state house, or any water company owning a water pipe system in any such city or town shall, except in case

of emergency, use, for domestic purposes, water from any source not now used by it except as herein provided or as shall be hereafter authorized by the legislature. If any town or towns in said district shall take the franchise, works and property in such town or towns, of any water company, the compensation to be allowed and paid therefor shall not be increased or decreased by reason of the provisions of this act. No town in said water district now supplied with water by a water company owning the water pipe system in such town, shall introduce water from the metropolitan water works until it shall first have acquired the works of such company.

when authorized by legislature.

No town to introduce water from metropolitan supply till works of water company have been acquired.

SANITARY PROTECTION OF WATER.

SECTION 24. The state board of health is hereby authorized and required to make rules and regulations for the sanitary protection of all waters used by the metropolitan water board for the water supply of any city, town or water company aforesaid, and to transfer and deliver to said water board, such plans, maps and other information in their possession as will assist said board in carrying out the provisions of this act.

Rules for protection of water used by board.

Plans, maps and other information to be transferred to board.

IMPROPER USE OF WATER PROHIBITED.

SECTION 25. No person shall take or divert any water of a water supply of any city or town in said water district from any water source, reservoir, conduit or pipe used for supplying such water to, or in any such city or town, or occupy, injure or interfere with any such water, or with any land, building, aqueduct, pipe, drain, conduit, hydrant, machinery or other work or property so used, and no person shall corrupt, render impure, waste or improperly use, any such water.

Water not to be diverted.

Buildings, machinery, etc., not to be injured.

PRECEDING SECTION NOT TO APPLY IN CERTAIN CASES.

SECTION 26. The provisions of the preceding section shall not apply to any person in taking or diverting any such water or interfering with or occupying any water, land or works therein described, by permission of said metropolitan water board, or the water board, water commissioners or superintendent of any city or town having charge of the land, water or work; nor to the individual inhabitants of any city or town within the watershed of any water supply used by said metropolitan water board, or by any city or town aforesaid, in taking

Not to apply where water, land, etc., are taken or occupied by permission of board.

Nor to inhabitants of any city or town taking water for ordinary uses.

from the part of the supply or from the tributaries of the supply within their respective city or town limits so much of the water thereof as they shall need for their ordinary domestic household purposes, for extinguishing fires, or for generating steam.

ENFORCEMENT.

Board to enforce act and rules, etc., made thereunder.

May enter upon land for that purpose.

Act not to be enforced until sewage is provided for.

Sewage works to be operated as part of water works.

SECTION 27. Said metropolitan water board, and their employees designated for the purpose, shall enforce the provisions of this act, and of the rules, regulations and orders made thereunder, and may enter into any building, and upon any land for the purpose of ascertaining whether sources of pollution there exist, and whether the provisions of this act and of the rules, regulations and orders made as aforesaid are complied with; and, where the enforcement of any such provisions, rules, regulations or orders will require public works for the removal or purification of sewage, said metropolitan water board shall not enforce the same until they have provided such works, and the amount paid therefor shall be considered as part of the expenses of construction of the metropolitan water works, and such works shall be maintained and operated as a part of said water works.

JURISDICTION OF THE COURTS.

Supreme judicial and superior courts have jurisdiction in equity to enforce provisions of act.

SECTION 28. The supreme judicial court or any justice thereof, and the superior court or any justice thereof, shall, in term time or vacation, on the petition of said board or any city, town, corporation or person interested, or of the attorney of any such petitioner, have jurisdiction in equity or otherwise to enforce the provisions of this act, and of any rule, regulation or order made under the authority of this act, and to prevent any violation of said provisions, rules, regulations or orders.

PENALTIES.

To be punished by fine or imprisonment, or both.

SECTION 29. Whoever shall do any of the acts herein prohibited, or shall violate or refuse to comply with any rule, regulation or order made under the authority of this act shall, on complaint or indictment therefor and conviction thereof, be punished for each offence by a fine not exceeding five hundred dollars, to be paid to the Commonwealth, or by imprisonment not exceeding one year in the house of correction, or by both such fine and imprisonment.

GENERAL LAWS.

SECTION 30. All general laws relating to the water supplies of cities and towns or the lands and other property used for such supplies shall, so far as they are not inconsistent with the provisions of this act, apply to and be observed in carrying out the purposes of this act. General laws to be observed.

CONSTRUCTION OF WORKS.

SECTION 31. In the construction of these works preference in employment shall be given to citizens of this Commonwealth. Preference to be given to citizens.

SECTION 32. This act shall take effect upon its passage.
[Approved June 5, 1895.]

APPENDIX No. 4.

[Chapter 486 of the Acts of the Year 1896.]

AN ACT RELATIVE TO THE COMPENSATION FOR DAMAGES OCCASIONED
BY THE CONSTRUCTION OF THE METROPOLITAN WATER SYSTEM.

Be it enacted, etc., as follows:

SECTION 1. Section sixteen of chapter four hundred and eighty-eight of the acts of the year eighteen hundred and ninety-five is hereby amended by striking out in the eleventh line, the word "two", and inserting in place thereof the word: — three, — so as to read as follows: — *Section 16.* The treasurer of the Commonwealth shall, from the proceeds of the bonds hereinafter provided for, reimburse the city of Boston for all moneys paid or that may hereafter be paid by said city for land damages, or otherwise, in connection with the location, building or maintenance of reservoirs or basins not yet built, or for lands taken for the preservation or protection of the purity of the waters of any reservoirs, or basins or of the tributaries thereof, and shall pay as part of the expenses of said metropolitan water works to the town of Boylston the sum of three thousand dollars a year and to the town of West Boylston the sum of twelve thousand dollars a year for the year of and each year succeeding said taking of the waters of said Nashua river, so long as each of said towns remains a municipality, and shall pay no tax or other payment to either of said towns on account of any property held by said water board for the purposes of a water supply. 1895, 488, § 16, amended.
City of Boston to be reimbursed and certain sums to be paid to towns of Boylston and West Boylston.

SECTION 2. This act shall take effect upon its passage.
[Approved May 27, 1896.]

APPENDIX No. 5.

[Chapter 450 of the Acts of the Year 1896.]

AN ACT RELATIVE TO THE COMPENSATION OF EMPLOYEES IN WEST BOYLSTON.

Be it enacted, etc., as follows:

Certain persons
deprived of
employment in
West Boylston
may file claim
for damages.

SECTION 1. Any resident of the town of West Boylston employed by any corporation, partnership or individual at the time when the plant of such corporation, partnership or individual is taken, and work therein stopped, on account of a reservoir for the metropolitan water supply, and who is obliged by reason of such taking to seek employment elsewhere, shall have the right for one year from the termination of such employment as aforesaid to file a claim for damages with the metropolitan water commission, and if the same is not settled within sixty days from the filing thereof, he may bring a bill in equity in the superior court for the county of Worcester for the adjudication and collection of such damage. Any number of persons deprived of employment as aforesaid may unite in such bill, and the withdrawal of any shall not prejudice the rights of others.

Court to ascer-
tain certain
facts, etc.

SECTION 2. It shall be the duty of the court to ascertain whether or not such claimants have resided and been employed and deprived of employment as specified in this act, and if so to issue a decree in favor of each to recover the actual damage which he has suffered by reason of such loss of employment, not however to exceed the sum of his wages for six months at the rate of wages paid to him for the last six months prior to such suspension of employment.

Certain em-
ployees not
entitled to
receive
compensation.

SECTION 3. No person shall be entitled to receive compensation under this act unless he shall have been employed in the town of West Boylston continuously from the date when chapter four hundred and eighty-eight of the acts of the year eighteen hundred and ninety-five, entitled "An Act to provide for a metropolitan water supply", became a law, up to the date of the taking of the property wherein said person is employed.

Stockholders
not entitled
to receive
compensation.

SECTION 4. No stockholder of any corporation whose plant is taken on account of a reservoir for said metropolitan water supply shall be entitled to receive compensation under this act.

SECTION 5. This act shall take effect upon its passage.
[Approved May 28, 1896.]



DEER ISLAND PUMPING STATION

DWELLING HOUSE FOR EMPLOYEES.

PUBLIC DOCUMENT

. . . . No. 45.

EIGHTH ANNUAL REPORT

OF THE

BOARD

OF

METROPOLITAN SEWERAGE

COMMISSIONERS,

FOR THE

YEAR ENDING SEPTEMBER 30, 1896.

BOSTON :

WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.

1897.

Commonwealth of Massachusetts.

To the Honorable the Senate and the House of Representatives.

The Board of Metropolitan Sewerage Commissioners, created by chapter 439, Acts of 1889, presents its annual report, which is the eighth since its organization, and covers the year ending Sept. 30, 1896.

In our report for 1895 (Public Document No. 45, 1896), the practical completion and opening of the north metropolitan line to the towns and cities thereon, with the exception of about five hundred feet of Section 35 in the city of Somerville, was reported. The latter section was so far completed that on Dec. 28, 1895, notice was sent to the proper authorities of the cities of Medford and Somerville that on and after Jan. 5, 1896, the said section would be in operation, and connections could be permitted therewith upon application to this Board. This and the Charles River system have been continually in operation during the year.

The work of construction has progressed steadily upon the Neponset valley system since the Board voted at its meeting of June 5, 1895, to enter upon the construction thereof as authorized by chapter 406, Acts of 1895. Your attention is respectfully invited to the report of our chief engineer, and the tables following in connection with this report, for fuller details.

NORTH METROPOLITAN SYSTEM.

In our last report, speaking of this system, after stating that about five hundred feet of Section 35 in Somerville remained to be constructed, we say : —

When this is completed the total length of sewer upon this system will be about forty-one miles, varying in size from a brick sewer nine feet in diameter at Deer Island, Winthrop and East Boston, to a vitrified pipe sewer twelve, fifteen or eighteen inches in diameter at the opposite termini. This, with the eight and one-quarter miles in the Charles River valley, makes about fifty miles of metropolitan sewers constructed and in operation at this date.

The following settlements for land taken upon this system have been made during the year : —

On Oct. 5, 1895, Wm. B. Rice, by his attorney, A. D. McLellan, made a settlement with the Commonwealth for land in Winthrop, included within the taking of May 7, 1890, recorded in Suffolk Registry of Deeds, book 1934, page 487 ; and on the 31st of the same month the Boston Ice Company released to the Commonwealth “ rights, privileges and easements ” in land in Winchester and Woburn, included within the taking made by this Board dated June 2, 1894, and recorded in Middlesex South District Registry, book 2282, page 388. The deed of the ice company is recorded in the aforesaid registry, book 2415, page 329.

On Nov. 14, 1895, settlement was had with Gilbert Lincoln, owner of an estate in Canal Street, West Medford, including a claim for damages to a well on said premises as well as for damage to said Canal Street, a private way included within the taking made by this Board Dec. 23, 1891, and recorded with Middlesex South District Registry, book 2089, page 361. By deed dated Jan. 21, 1896, recorded Middlesex South District Registry, book 2437, page 570, Right Rev. John J. Williams, Archbishop of Boston, quit-claims to the Commonwealth “ rights, privileges and easements ” in land in Medford belonging to him and used for St. Joseph’s Church, included within the taking made by this Board Nov. 25, 1891, and recorded in Middlesex South District Registry, book 2083, page 368.

A deed from Nancy White and others, recorded in Middlesex South District Registry, book 2437, page 569, and dated Nov. 25, 1895, releases the Commonwealth, its officers, agents and servants, from all suits, claims and demands for damages and costs to lands in Woburn, included within a taking made by this Board April 15, 1893, recorded in Middlesex South District Registry, book 2186, page 585; and a deed dated Jan. 10, 1896, from John J. McCormack and others (recorded in Middlesex South District Registry, book 2437, page 571), conveys to the Commonwealth "rights, privileges and easements" in certain lands in Somerville, included within the taking dated May 20, 1893, recorded in Middlesex South District Registry, book 2197, page 139; also a certain parcel of land in fee, with all the rights, privileges and appurtenances thereto belonging, in said Somerville, included within the taking by this Board dated April 27, 1895, and recorded in Middlesex South District Registry, book 2361, page 45.

Philip J. Blank of Winchester, by deed dated March 10, 1896, recorded in Middlesex South District Registry, book 2457, page 566, quit-claims to the Commonwealth "rights, privileges and easements" in two parcels of land in said Winchester, included within a taking made by this Board June 2, 1894, recorded in Middlesex South District Registry, book 2282, page 388.

The President and Fellows of Harvard College, by deed dated April 28, 1896, recorded in Middlesex South District Registry, book 2511, page 330, released to the Commonwealth "rights, privileges and easements" in land in Cambridge, included within the taking made by this Board July 19, 1893, and recorded in Middlesex South District Registry, book 2210, page 481; and similar rights in land lying in the same neighborhood and taken at the same time, belonging to John Holmes and others, have been released by deed dated May 15, 1896, recorded in Middlesex South District Registry, book 2511, page 329.

Damages sustained by sundry persons in their real estate included within takings made at various times by this Board were paid by the Commonwealth upon executions issued from the superior court, as follows: October, 1895, David

Fisher, Woburn, included within the taking made April 15, 1893, and recorded in Middlesex South District Registry, book 2186, page 585; November, 1895, Orray A. Taft, Winthrop, partly in fee, by taking dated April 13, 1890, and recorded in Suffolk Registry, book 1932, page 583, and also by taking dated May 7, 1890, recorded in Suffolk Registry, book 1934, page 487; January, 1896, Martha McLean, Cambridge, included within a taking made July 19, 1893, and recorded in Middlesex South District Registry, book 2210, page 481; January, 1896, H. C. Greene, Everett, by taking dated Oct. 28, 1891, and recorded in Middlesex South District Registry, book 2076, page 262; January, 1896, Frederick M. Burrows, Somerville, included within a taking made May 20, 1895, and recorded in Middlesex South District Registry, book 2197, page 139; January, 1896, Peter C. Brooks, Medford, included within a taking made Dec. 23, 1891, recorded in Middlesex South District Registry, book 2089, page 361, and also by taking dated Jan. 2, 1892, and recorded in Middlesex South District Registry, book 2090, page 291; January, 1896, heirs of Gorham Brooks (Shepard Brooks), Medford and Winchester, included within a taking made July 14, 1893, and recorded in Middlesex South District Registry, book 2210, page 162; April, 1896, Mary Call, Woburn, by taking made April 15, 1893, and recorded in Middlesex South District Registry, book 2186, page 585; April, 1896, Mary Penney, Cambridge, by taking made Jan. 7, 1893, and recorded in Middlesex South District Registry, book 2169, page 457. The settlement with Mary Penney includes land taken from Fred. H. Rindge at the same time, damage to which was assigned to her by the said Rindge.

LAND TAKINGS.

No new takings have been made during the year. The additional takings at the East Boston and Charlestown pumping stations, reported in the last annual report (Public Document No. 45, 1896, pages 11 to 13 inclusive) as licensed by the Board of Harbor and Land Commissioners, were submitted to the Honorable Secretary of War, Washington, D. C., for approval early in October, 1895, and replies were received as follows:—

WAR DEPARTMENT, WASHINGTON, D. C., Oct. 19, 1895.

SIR:— Replying to your application of 4th instant, inclosed please find for retention an instrument for granting permission to the Board of Metropolitan Sewerage Commissioners of Massachusetts to extend the structures at Charlestown pumping station, in Mystic River, at Charlestown, Mass.

Very respectfully,

(Signed)

DANIEL S. LAMONT,
Secretary of War.

HOSEA KINGMAN, Esq.,

*Chairman Metropolitan Sewerage Commissioners,
110 Boylston Street, Boston, Mass.*

With the foregoing communication was inclosed the following instrument attached to the plan sent to the War Department:—

Whereas, By section 3 of an act of Congress, approved July 13, 1892, entitled “An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors and for other purposes,” it is provided that, without the permission of the Secretary of War, it shall not be lawful to build any wharf, pier, dolphin, boom, dam, weir, breakwater, bulkhead, jetty, or structure of any kind outside established harbor lines, or where no harbor lines are or may be established, in any port, roadstead, haven, harbor, navigable river or other waters of the United States, in such manner as shall obstruct or impair navigation, commerce or anchorage of said waters;

And whereas, The Board of Metropolitan Sewerage Commissioners of Massachusetts has applied to the Secretary of War for permission to extend the structures at Charlestown pumping station in the Mystic River at Charlestown, Mass., as shown on the attached drawing;

Now, therefore, This is to certify that the Secretary of War hereby gives permission to the said Board of Metropolitan Sewerage Commissioners to extend the structures at Charlestown pumping station in Mystic River at Charlestown, Mass., as shown on said drawing, upon the following condition:—

That the work herein permitted to be done shall be subject to the supervision and approval of the engineer officer of the United States Army in charge of the locality.

Witness my hand this eighteenth day of October, 1895.

(Signed)

DANIEL S. LAMONT,
Secretary of War.

[SEAL]

WAR DEPARTMENT, WASHINGTON, D. C., Oct. 19, 1895.

SIR:—Replying to your application of 4th instant, inclosed please find for retention an instrument granting permission to the Board of Metropolitan Sewerage Commissioners of Massachusetts to extend the structures at East Boston pumping station in Chelsea Creek, Mass.

Very respectfully,
(Signed)

DANIEL S. LAMONT,
Secretary of War.

HOSEA KINGMAN, Esq.,
*Chairman Metropolitan Sewerage Commissioners,
110 Boylston Street, Boston, Mass.*

With the foregoing communication was inclosed the following instrument attached to the plan sent to the War Department:—

Whereas, By section 3 of an act of Congress, approved July 13, 1892, entitled “An act making appropriations for the construction, repair and preservation of certain public works on rivers and harbors and for other purposes,” it is provided that, without the permission of the Secretary of War, it shall not be lawful to build any wharf, pier, dolphin, boom, dam, weir, breakwater, bulkhead, jetty or structure of any kind outside established harbor lines, or where no harbor lines are or may be established, in any port, roadstead, haven, harbor, navigable river or other waters of the United States, in such manner as shall obstruct or impair navigation, commerce or anchorage of said waters;

And whereas, The Board of Metropolitan Sewerage Commissioners of Massachusetts has applied to the Secretary of War for permission to extend the structures at East Boston pumping station in Chelsea Creek, Mass., as shown on the attached drawing;

Now, therefore, This is to certify that the Secretary of War hereby gives permission to the Board of Metropolitan Sewerage Commissioners to extend the structures at East Boston pumping station in Chelsea Creek, Mass., as shown on said drawing, upon the following condition:—

That the work herein permitted to be done shall be subject to the supervision and approval of the engineer officer of the United States Army in charge of the locality.

Witness my hand this eighteenth day of October, 1895.

(Signed)

DANIEL S. LAMONT,
Secretary of War.

[SEAL]

The above communications from the War Department at Washington, D. C., licenses the structures petitioned for, and all such structures within tide-water are now fully completed.

CONTRACTS.

The contracts on this system have been but few during the past year, and relate to the completion of the pumping stations at Deer Island, Charlestown and Alewife Brook. On Oct. 4, 1895, the following bids were received for marble flooring at the pumping station at Charlestown: —

Philip H. Butler & Co., Boston,	. . . .	\$780 00
Bowker, Torrey & Co., Boston,	. . . .	859 00
Chas. E. Hall & Co., Boston,	. . . .	928 00

No action was taken on these bids, the engineer being directed to obtain bids for granolithic flooring at this station and also at the station at Alewife Brook.

At the succeeding meeting of the Board the engineer submitted the following communication: —

ABERTHAW CONSTRUCTION COMPANY,

31 STATE STREET, BOSTON, Oct. 10, 1895.

WM. M. BROWN, Jr., *Superintendent Metropolitan Sewerage Commissioners, Boston.*

DEAR SIR:— We will furnish all materials, labor, etc., and construct a three-inch granolithic pavement, first quality, for fourteen cents per square foot, at the Charlestown and Alewife Brook pumping stations. Germania cement used throughout, and all done in a strictly first-class manner, four-foot square blocks, blue top, smooth finish. Water to be furnished us. Hoping to receive your order, we beg to remain,

Yours very truly,

ABERTHAW CONSTRUCTION COMPANY.

T.

The Board thereupon voted to reject all bids received Oct. 4, 1895, for floor at the Charlestown station and to accept the bid of the aforesaid company for granolithic flooring at the Charlestown and Alewife Brook stations. These floors have since been constructed by said company, at a cost of \$254.66 for the Charlestown pumping station and \$104.64 for the Alewife Brook station.

On Oct. 19, 1895, the engineer was directed to obtain proposals for curbing at Deer Island and bids for interior finish at the Charlestown pumping station, and submit the same to the Board later; and on Oct. 26, 1895, the following bids were submitted for the interior finish at Charlestown:—

Mack & Moore, Boston, Mass.,	\$2,250 00
Wm. Richmond & Co., Boston, Mass.,	1,909 00
John S. Jacobs & Son, Boston, Mass.,	1,975 00
Hersee Bros., Roslindale, Mass.,	5,800 00
Wm. H. Keyes & Co., Boston, Mass.,	1,848 00

The Board then voted to accept the bid of Wm. H. Keyes & Co. for the interior finish at the Charlestown pumping station. At the same meeting the engineer also submitted two bids for curbing, rough and cut stone, for use at Deer Island,—one from Walter S. Lyons, Boston, and the other from S. & R. J. Lombard, Boston; and the Board directed him to accept the bid of the latter, amounting to about \$630.

Bids have been received for supplying the various pumping stations on this line with coal, particulars of which are given in Table A of the Appendix. The cost of said coal is charged to and appears in the table of expenses for operating and maintaining this system.

The cases mentioned in our last annual report as pending between contractors upon the work and the Commonwealth, for breach of their contract, have been settled during the year as follows: that of the Commonwealth *v.* McGovern & Kitch, contractors for the construction of Section 27 (Cambridge), was settled, after a trial in the Superior Court of the Commonwealth, by a payment of \$6,458.53 to the Commonwealth, which has been placed in the hands of the Treasurer, and under the provisions of chapter 192, Acts of 1891, will be applied to the payment of interest upon the loan authorized by chapter 439, Acts of 1889.

The claim of Trumbull & Ryan, contractors for the construction of Section 7, Belle Isle Inlet, was settled by the Commonwealth's payment to the said contractors on July 1, 1896, of \$5,000, the said contractors giving the Commonwealth a release, as follows:—

WE, Charles A. Trumbull of Lawrence, Mass., and William H. Ryan of East Boston, Mass., in consideration of five thousand dollars to us paid by the Commonwealth of Massachusetts, by order of the Metropolitan Sewerage Commissioners, do hereby acknowledge that we have received full payment and satisfaction of all claims against said Commonwealth, its officers, agents and servants, for work done or materials furnished for section seven of the north metropolitan system, or on account of any contracts relating thereto, or any action of said Board thereunder; and we do hereby release and discharge the said Commonwealth, its officers, agents and servants, from all claims and demands relating to or growing out of such contracts, and especially all claims by reason of the action of said commissioners in terminating the contract entered into with them for the construction of said section.

Witness our hands and seals this first day of July, eighteen hundred and ninety-six.

(Signed) CHARLES A. TRUMBULL. [L. S.]

(Signed) WILLIAM H. RYAN. [L. S.]

Witness: EDW. P. FISK, to both.

The last case mentioned in our former report, that of the Metropolitan Construction Company, contractors for construction of Section 39, was settled amicably out of court, after various suits and counter-suits had been entered, the Commonwealth paying the said company about fifty per cent. (\$3,500) of the amount withheld from their reserve.

CLAIMS OF CONTRACTORS.

Late in December, 1895, Jones & Meehan, contractors for construction of Section 44 (Winchester), submitted a bill for extras on said section, asking an early consideration thereof, and a hearing was appointed upon said claim and a claim previously filed for extras on Section 30 (Cambridge). This hearing was held Feb. 29, 1896, and afterwards the Board

Voted, To adhere to its vote passed April 7, 1894, awarding said contractors five hundred dollars (\$500) in full settlement for all claims upon this section (Section 30).

The Board also

Voted, To allow said contractors one hundred sixty-two and fifty one-hundredths dollars (\$162.50) in settlement for all claims upon Section 44, the same to be paid upon their giving the Commonwealth a release satisfactory to the attorney of the Board.

The contractors were duly notified of these votes, but have not as yet (October 1) accepted the award offered them.

MYSTIC VALLEY SEWER.

In our last annual report, after speaking of meeting the Sewer Board of Woburn on July 18, 1895, we say (page 26): —

On the same evening the keys of the purifying works in Winchester were delivered to a representative of this Board, and the works there located were closed and abandoned, the sewage formerly treated there being allowed to flow directly into the metropolitan sewer.

The effect of this change is treated more fully by the engineer in his report, to which your attention is respectfully called.

The city of Boston had conveyed with these works to the Commonwealth about five and one-half acres of land, for which this Board immediately began to receive applications for purchase. As the land in question had been taken or purchased by the city of Boston from the Boston & Lowell Railroad Corporation, which is now leased by and forms a part of the Boston & Maine system, this Board considered it advisable to offer said land to the Boston & Maine Railroad, which was done by the following letter:—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Oct. 21, 1895.

To the President of the Boston & Maine Railroad, Boston, Mass.

DEAR SIR:— This Board has offered for sale a tract of land in Winchester, embraced within a taking made July 14, 1893, and recorded in Middlesex South District Registry, book 2210, page

161. As they have had inquiries for it I have been directed to communicate with your corporation, to ascertain if you desire to purchase the same. The land in question embraces the site of the purifying works formerly operated by the city of Boston in connection with the Mystic valley sewer. An early reply would receive the attention of the Board if received in season to submit at the meeting on Saturday next.

For the Board,

Truly yours,

(Signed)

EDWARD P. FISK,

Clerk.

After considerable correspondence between this Board and President Tuttle, the following letter was received : —

BOSTON & MAINE RAILROAD, PRESIDENT'S OFFICE,
BOSTON, Dec. 19, 1895.

MR. EDWARD P. FISK,

Clerk Metropolitan Sewerage Commissioners,

110 Boylston Street, Boston, Mass.

DEAR SIR : — I am authorized to purchase the land at Winchester, about which we have been in correspondence, and to which you last referred in your letter to me of the 9th inst., containing about five and one-half acres, and to pay you therefor \$5,500.

Kindly advise me if this offer is accepted, and I will arrange to have our Mr. Sigourney Butler call upon you in regard to drawing the deeds and making payment.

Yours truly,

(Signed)

LUCIUS TUTTLE,

President.

To this the Board replied as follows : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Dec. 21, 1895.

LUCIUS TUTTLE, Esq., *President Boston & Maine Railroad, Boston, Mass.*

DEAR SIR : — Your proposition for the purchase of the land in Winchester, contained in your letter of the 19th inst., was considered by the Board at its meeting to-day, and was accepted, provided that the State shall reserve the barn, and all machinery now on the premises, and that the railroad shall convey to the Commonwealth a right of way over the existing roadway from Bacon

Street up to the sewer location for the purpose of maintaining the sewer, as will be more fully stated by our attorney, Mr. William D. Turner, who will confer with your Mr. Butler in regard to the conveyance.

For the Board,

Very truly yours,

(Signed)

EDWARD P. FISK,

Clerk.

The matter was then referred to Mr. Wm. D. Turner, the attorney of the Board, who, after consultation with Mr. Butler and this Board, presented to said Board, at its meeting on Feb. 15, 1896, a deed of even date, conveying to the Boston & Maine Railroad Company the land in question in Winchester, and the Board

Voted, To execute deed of this date, conveying to the Boston & Maine Railroad Company land in Winchester, shown on a plan of even date, entitled "Metropolitan Sewerage Commissioners," plan of land in Winchester, signed by William M. Brown, Jr., superintendent, and that the same be delivered on payment of consideration named in said deed.

The deed was executed by the full Board and acknowledged before the clerk as justice of the peace.

This conveyance was made under the provisions of chapter 251, Acts of 1892, and reserves to the Commonwealth certain machinery and a barn on the land, together with the right to "operate and maintain" the sewer in said land. The deed was delivered and the money, paid to our attorney March 16, 1896, was by him deposited with the Treasurer and Receiver-General of the Commonwealth, who, under the provisions of the aforesaid act, places it to the credit of the metropolitan sewerage loan fund.

The Board has disposed of one other piece of real estate during the past year. The house and lot, No. 63 Pearl Street, Chelsea, was purchased of Frederick Haslam, who conveyed it to the Commonwealth, by warranty deed dated April 28, 1892, for the purpose of constructing a portion of the sewer in that section by tunnelling. On Sept. 5, 1896, T. H. Buck, of T. H. Buck & Co., Chelsea, owners

of adjoining property in that neighborhood, agreed with this Board regarding the purchase of said estate, subject to the rights of the Commonwealth, to operate and maintain the sewer therein, and deposited with this Board a check for \$500, payable to the order of the Treasurer of the Commonwealth, agreeing to pay the balance (\$1,500) within one year. An agreement to this effect has been duly executed.

At the meeting of the Board on Nov. 2, 1895, the engineer submitted plan and papers from the town of Stoneham, in relation to a local system for said town, in connection with the metropolitan system, and they were referred to him for investigation; and at the subsequent meeting (November 9), he reporting favorably on said plans, the Board approved the same, leaving the matter of detail of connection with the metropolitan sewer to be approved when submitted. One connection for said town was approved by this Board at its meeting on June 6, 1896, which has not been made.

EXTENSION OF THE NORTH METROPOLITAN SYSTEM TO WAKEFIELD.

At its meeting on Dec. 7, 1895, a communication from a committee of the town of Wakefield, asking for information regarding sewerage for the villages of Greenwood and Boyntonville in said town, was received and replied to; and on Dec. 14, 1895, the committee, with Louis E. Hawes, the engineer, waited upon the Board, asking that the Board would draft an act providing for the connection of said villages with the north metropolitan system. They were advised to prepare an act according to their ideas and submit the same to the Board for criticism.

The Board at its meeting on Feb. 15, 1896, received from the said committee a communication embodying the provisions contained in the first three sections of the bill presented in House Document No. 798 (1896), entitled "An act relating to sewerage and sewage disposal for the town of Wakefield."

[HOUSE No. 798.]

AN ACT RELATING TO SEWERAGE AND SEWAGE DISPOSAL FOR THE
TOWN OF WAKEFIELD.

SECTION 1. The territory comprising the villages of Greenwood and Boyntonville in the town of Wakefield is hereby added to the north metropolitan sewerage district, created by chapter four hundred and thirty-nine of the acts of the year eighteen hundred and eighty-nine, entitled "An act to provide for the building, maintenance and operation of a system of sewage disposal for the Mystic and Charles river valleys."

In becoming a part of the metropolitan system, the proportionate liability incurred by said addition shall be assumed by the town of Wakefield, and any authority granted to other municipalities in said act, or amendments thereto, is hereby also vested in said town of Wakefield, but limited in application to the territory comprising said addition.

SECT. 2. Said addition shall be subject to the provisions and conform with the requirements of the aforesaid act and amendments thereto, except that no apportionment for assessing the interest, sinking fund and maintenance expenses as therein provided shall be made for said addition earlier than the year nineteen hundred.

In case the sewers of said addition are connected with the outlet provided by the metropolitan sewerage commissioners prior to the year nineteen hundred, then back assessments with interest, beginning with the year in which such connection is made, and in accordance with the apportionment calculated for the five-year period next following, shall be levied on the said town of Wakefield by the treasurer of the Commonwealth.

SECT. 3. The metropolitan sewerage commissioners shall provide an outlet at the Wakefield town line in Greenwood street for the sewage of said addition, which shall connect with and become a part of the present trunk sewers of the metropolitan system, controlled by said board. In providing said outlet and connection and in receiving sewage from said addition, or any action in relation thereto, said board of sewerage commissioners shall conform with the provisions and have and exercise all the authority conferred upon them by said chapter four hundred and thirty-nine of the acts of the year eighteen hundred and eighty-nine, and amendments thereto, regarding the original system or anything relating thereto, except as herein otherwise provided.

This communication was referred to the chairman with full powers, who in due time sent the following reply : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, March 6, 1896.

LOUIS E. HAWES, *Chairman Sewerage Committee, Wakefield, Mass.*

DEAR SIR : — The following amendment is suggested to your bill, House Document No. 798, now pending before the Legislature : —

Amend section 3 in the third line by inserting after the word “addition” and before the word “which” the words “by the construction of a sewer from that point,” and by inserting after the word “providing” in the fifth line the words “and constructing.”

The bill should provide a fund of at least twelve thousand dollars (\$12,000) (which would be the probable cost of construction of the sewer), and this would be made a part of the metropolitan sewerage loan, and provision for its payment similar to that made in chapter 294, Acts of 1895, should be made, with like provision for its apportionment upon the cities and towns in that system.

If this act should provide for the immediate construction of this sewer, the apportionment for assessing the interest, sinking fund and maintenance expenses should commence at once and be provided for in the act, and should not be deferred until the year 1900.

Very truly yours,

(Signed)

HOSEA KINGMAN,
Chairman.

To this the following reply was received : —

BOSTON, MASS., March 24, 1896.

HOSEA KINGMAN, Esq., *Chairman Metropolitan Sewerage Commissioners.*

DEAR SIR : — Inclosed please find a copy of section 2 of the Wakefield act, as revised by the Melrose folks. The amount of the appropriation is not yet determined. Aside from that, can we say to the drainage committee of the Legislature that you approve the bill as now prepared?

Yours very respectfully,

(Signed)

LOUIS E. HAWES.

SECT. 2. The metropolitan sewerage commissioners shall provide an outlet at the Wakefield town line in Greenwood street for

the sewage of said addition, and the present sewer constructed by the town of Melrose through Wyoming avenue, Berwick, Grove, Myrtle, Essex and Tremont streets to Lake avenue shall become and is hereby made a part of the main trunk line of sewers belonging to the metropolitan system. The town of Melrose shall be reimbursed by the metropolitan sewerage commissioners for the cost of construction of the same; and the metropolitan sewerage commissioners shall at once extend the said main sewer line to the Wakefield town line by constructing a main sewer through Tremont street, Melrose, Belmont, Franklin and Greenwood streets; and the town of Melrose shall have the right to maintain and make house connections with the said main sewers and connect lateral sewers therewith in the same manner as with the present sewers of the town. In providing said outlet and in taking said sewer line constructed by Melrose, and in constructing a sewer through Melrose to the Wakefield town line, and in receiving sewage from said addition and said town of Melrose, and in any action in relation thereto, said board of sewerage commissioners shall conform with the provisions and have and exercise all the authority conferred upon them by chapter four hundred and thirty-nine of the acts of eighteen hundred and eighty-nine, and amendments made thereto, regarding the original system or anything relating thereto, except as herein otherwise provided.

This Board through its chairman replied as follows : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, March 25, 1896.

LOUIS E. HAWES, Esq., 75 State Street, Boston, Mass.

MY DEAR SIR : — Yours inclosing change in the Wakefield proposed bill duly received. You say the inclosed is a revision of section 2. I think you must mean section 3. There are several serious objections to the proposed changes in that section. There is no provision made for any taking by purchase or otherwise of the sewer constructed by Melrose or for compensation to Melrose therefor, and no provision for determining the amount of such compensation either by agreement, or other method in case of failure to agree. The proposed change imposes upon the Metropolitan Sewerage Commission the burden of paying for this sewer constructed by Melrose. Now, personally I do not want that sewer, and much less do I wish to be asked by an act of the Legislature to pay for it. There should be some provision somewhere

in the act proposed making such appropriation as may be necessary to carry out the purpose of the act. Again, your proposed change would make the Melrose sewer a part of the metropolitan system (a trunk sewer), and yet so far as its use and connections therewith are concerned leaves it entirely within the jurisdiction and control of the town of Melrose (a town sewer).

Very truly yours,

(Signed)

HOSEA KINGMAN,
Chairman.

Chapter 414, Acts of 1896, resulted from these efforts, but the amount (thirty thousand dollars) therein appropriated for the work is estimated by our engineer to be too small by five thousand dollars (see his report), and we would respectfully recommend that that amount be authorized in addition. The amount expended to date is \$125.98.

PUMP TESTS.

At the meeting of Oct. 19, 1895, the chief engineer presented to the Board the following communication:—

THE EDWARD P. ALLIS COMPANY, MILWAUKEE, WIS., Oct. 10, 1895.

Metropolitan Sewerage Commission,

Mr. WM. M. BROWN, Jr., *Chief Engineer,*

110 Boylston Street, Boston, Mass.

DEAR SIR:—As you are aware, our Mr. Lewis has been engaged in making preliminary tests of our engines and boilers at the East Boston station, and it is probable that in the near future we shall be ready for an official test of the machinery. In this connection we would suggest that, as the engines and pumps are exact duplicates, both at Deer Island and East Boston, the expense can be very much reduced, and the interruption of the service would be very much less, if one engine at one of the stations be selected for the official test; and we would suggest East Boston as being the most convenient place to make the test, on account of its ready accessibility as compared with Deer Island.

The question of location of weir is one that should be carefully considered, as we believe the weirs used in the capacity tests, while necessarily arranged as they were, did not give the engines credit for the actual head which they were working against; and, if the weirs are to be located in the same positions, arrangements should

be made for measuring the head against the pumps at some point nearer the pumps, so as to get at the actual resistance. In our opinion, however, it is entirely unnecessary to have a weir at all for making the *duty trials*, for the reason that the capacity tests previously made have established the speed necessary to deliver the contract quantity of water against the contract head; consequently, if the engines are operated at the speed which was found necessary to deliver the quantity, and against the contract head, the quantity of water delivered will be exactly the same as shown by the capacity test. In other words, the previous tests show that it required about eighty revolutions per minute to deliver seventy cubic feet of water per second against a head of fifteen feet; consequently, if the engines are operated at eighty revolutions per minute against fifteen feet head, the quantity of water delivered will be seventy cubic feet per second. (The above figures are close approximations only, and to determine the exact speed would require averaging the capacity tests previously made.) The above method is accurate for centrifugal pumps, for the reason that there are no plungers to leak or valves to give out, the quantity of water depending entirely on the speed of the pump wheel and height to which the water is raised.

The advantage of making tests in this way would be that there need be no interruption of the service, which would be necessary in pumping over a weir, it simply being necessary to supply the proper amount of water for the pumps. In this connection we would say that so far our Mr. Lewis has been unable to get as reliable figures as we would like to have, on account of the lack of water necessitating very short trials, and we should have sufficient water supplied to the sewer to enable the engines to be run at the rate of seventy cubic feet per second for at least twelve hours, and we trust we will be able to make arrangements to do this for Mr. Lewis.

Yours truly,
(Signed) THE EDWARD P. ALLIS COMPANY,
By IRVING H. REYNOLDS.

At the meeting of Oct. 26, 1895, the Board

Voted, That a test be made by the Allis Company of all pumps at East Boston and Deer Island, and the expense of the same charged to the appropriation for maintaining the north metropolitan system.

The Allis Company was duly notified, as will appear by the following communication : —

THE EDWARD P. ALLIS COMPANY, MILWAUKEE, WIS., Oct. 31, 1895.

Metropolitan Sewerage Commission,

Mr. WM. M. BROWN, Jr., *Superintendent,*

110 Boylston Street, Boston, Mass.

DEAR SIR : — We are in receipt of yours of October 29, and note that you have decided to run each of the four pumps under the full contract test. We will accordingly get all of the engines in condition for testing, and when ready will notify you.

In the mean time, we will ask what provision you propose to make for measuring the amount of water pumped at the different stations. We would suggest that the weirs be placed on the main line of the discharge, as the previous arrangements of weirs were unsatisfactory to us, and we believe did not give us the credit to which we were entitled.

Yours truly,

(Signed)

THE EDWARD P. ALLIS COMPANY,
By IRVING H. REYNOLDS.

At the meeting of Dec. 28, 1895, the engineer, reporting on certain matters connected with tests of the pumps at the various stations, was directed to proceed with said tests as speedily as possible.

The following telegram was laid before the Board at its meeting on Feb. 15, 1896 : —

MILWAUKEE, WIS., Feb. 11, 1896.

Metropolitan Sewerage Commission, 110 Boylston Street, Boston.

We respectfully protest that further capacity tests are wholly unnecessary. We do not understand that the capacity of the pumps is in question, as the former tests of your engineers and the present duty trials show there is no doubt of their being fully up to guaranteed capacity.

THE EDWARD P. ALLIS COMPANY.

Upon the recommendation of the engineer that the capacity tests of these engines already made have demonstrated that they fully meet the contract requirements, it was

Voted, That no further capacity tests be made.

The Allis Company was notified of this decision, as will be seen by the following communication : —

THE EDWARD P. ALLIS COMPANY, MILWAUKEE, WIS., Feb. 15, 1896.

Metropolitan Sewerage Commission,

Mr. WM. M. BROWN, Jr., *Superintendent,*

110 Boylston Street, Boston, Mass.

DEAR SIR : — We are in receipt of your telegram of the 15th, saying "Board voted to omit further capacity tests Deer Island and East Boston." We are pleased to note this, as it will facilitate the completion of the remaining tests, and we could see no necessity for repeating the capacity tests. We trust you will complete the arrangements for the duty tests at Deer Island as early as possible.

Yours truly,

(Signed)

THE EDWARD P. ALLIS COMPANY,
By IRVING H. REYNOLDS.

At the meeting of April 18, 1896, Wm. M. Brown, Jr., superintendent, submitted reports upon capacity and duty trials of pumping plants at Deer Island and East Boston pumping stations (see engineer's report), which were accepted and placed on file. These reports, showing that the bonus under the contract in each case was more than earned, the Board

Voted, To accept said plants and pay the bonus thereon.

The Board thereupon approved the balance due the contractors upon the pumping plants at Deer Island and East Boston, less ten per cent. of the value thereof, which by the terms of the contract they are authorized to hold for one year to cover any necessary expenses for repairs, together with the bonus, \$10,000 at East Boston pumping station and \$8,000 at the Deer Island station. The ten per cent. reserve in each case amounts to \$4,700, and is held under the following clauses : —

SECT. S. The contractor hereby further agrees that the said board is hereby authorized to retain out of the moneys payable to the contractor, under this agreement, the sum of ten per cent. remaining due on the amount of the contract, and to expend the same in the manner hereinafter provided for in making such repairs of the plant as the engineer may deem expedient.

SECT. T. The contractor further agrees that if, at any time during a period of one year from the date of the final completion of the work contemplated in this contract, any part of said work shall, in the opinion of the said engineer, require repairing, and the said engineer shall notify the said contractor, in person or by mail, to make the repairs so required; and that if the said contractor shall neglect to make such repairs, to the satisfaction of the said engineer, within reasonable time from the date of giving or mailing of such notice to the said contractor, his agent or attorney, then the said engineer shall have the right to employ such other person or persons as he may deem proper to make the same; and the said board shall pay the expenses thereof out of the sum retained for that purpose by it as before mentioned. And the said board further agrees, upon the expiration of the said period of one year, provided that the said work shall at that time be in good order, that the said contractor shall be entitled to receive the whole or such part of the sum last aforesaid as may remain after the expense of making the said repairs, in the manner aforesaid, shall have been paid therefrom.

At the meeting of June 20, 1896, the engineer submitted a report upon the tests of the pumping plant at the Charlestown pumping station (see engineer's report), showing that the contractor was entitled to the full amount of bonus, and the same was accepted and placed on file. The Board then

Voted, To accept the pumping plant erected by the Edward P. Allis Company at the pumping station, Charlestown, and to pay them the full amount of bonus thereon.

The contract for the pumping plant at this station amounted to \$35,000, and contained the clauses above quoted, relating to the other pumping stations, authorizing the Board to withhold ten per cent. (\$3,500) for one year, to cover necessary repairs. The Board accordingly approved the bonus allowed (\$3,000), together with the balance due the contractor, reserving said ten per cent. (\$3,500). These reservations (\$12,900 in all) due the Allis Company will be payable in April and June, 1897, less any necessary expenses meantime. At its meeting on Sept. 5, 1896, upon recommendation of the chief engineer, the Board voted to authorize the running of the several pumping stations continuously thereafter, the operations up to that time having covered only portions of the twenty-four hours each day.

CONNECTIONS WITH THE METROPOLITAN SEWER ON THIS SYSTEM.

In our last annual report (pages 27-30) thirty-one connections were shown as having been made to Oct. 1, 1895. During the year ending Sept. 30, 1896, twenty-six connections were authorized upon this system, as shown in the following table : —

Connections with North Metropolitan Sewer, authorized for the Year ending Sept. 30, 1896.

DATE AUTHORIZED.	City or Town.	Location of Connection.	Size.	Date of Completion.
May 25, 1895,	Woburn, .	Canal and Lake streets, . . .	15" pipe,	Oct. 9, 1895.
Sept. 14, 1895,	Boston, .	Orleans and Decatur streets, East Boston,	16" pipe,	To be made.
Aug. 10, 1895,	Cambridge,	Willard Street, at Mt. Auburn Street,	12" pipe,	Oct. 11, 1895.
Oct. 12, 1895,	Winthrop, .	Shirley Street, Short Beach, .	10" pipe,	Oct. 29, 1895.
Sept. 7, 1895,	Woburn, .	In private land for Bader-Adams & Company, glue works, through settling tanks, . .	8" pipe,	Nov. 9, 1895.
Oct. 4, 1895,	Cambridge,	Near Concord Avenue, for Niles Bros., slaughtering establishment,	8" pipe,	Nov. 30, 1895.
Oct. 4, 1895,	Cambridge,	Mt Auburn and Hawthorne streets,	16" pipe,	Dec. 12, 1895.
Nov. 30, 1895,	Winchester,	275 feet south of Swanton Street, Station 5+11 20, Section 45, .	15" pipe,	Dec. 21, 1895.
Sept. 7, 1895,	Medford, .	On Mystic Avenue, at the end of Section 35,	20" pipe,	Jan. 6, 1896.
Nov. 9, 1895,	Somerville, .	On Mystic Avenue, at Moreland Street,	12" pipe,	Mar. 21, 1896.
Nov. 30, 1895,	Boston, .	Butler Avenue, Orient Heights, East Boston,	12" pipe,	Jan. 23, 1896.
April 25, 1896,	Somerville, .	Corner Mystic and Winthrop avenues,	30" brick,	May 29, 1896.
March 14, 1896,	Cambridge,	Dunster Street,	12" pipe,	June 1, 1896.
May 9, 1896,	Arlington, .	At the end of metropolitan sewer in Decatur Street,	18" pipe,	June 20, 1896.
March 14, 1896,	Cambridge,	Corner Dyke and Plympton streets,	30" pipe,	June 30, 1896.
May 16, 1896,	Somerville, .	Corner Rowland and Waverly streets,	24" pipe,	July 21, 1896.
June 6, 1896,	Stoneham, .	At the end of the metropolitan sewer, at Montvale Avenue, .	15" pipe,	To be made.
July 1, 1896,	Medford, .	Boston Avenue,	8" pipe,	July 23, 1896.
Oct. 19, 1895,	Cambridge,	Brookline Street, near Cottage Farm Station, Boston & Albany Railroad,	10" pipe,	Aug. 1, 1896.

Connections with North Metropolitan Sewer, etc.—Concluded.

DATE AUTHORIZED.	City or Town.	Location of Connection.	Size.	Date of Completion.
May 23, 1896,	Boston, .	Condor Street, near Meridian Street, East Boston,	15" pipe,	Aug. 14, 1896.
Aug. 1, 1896,	Boston, .	A. B. Heath, Institutions Com- missioner, Deer Island, about Station 12+80,	8" pipe,	Aug. 21, 1896.
Aug. 1, 1896,	Winchester,	On the westerly side of the metro- politan sewer, in the Mystic val- ley parkway, at man-hole, .	18" pipe,	Aug. 25, 1896.
July 22, 1896,	Cambridge,	In private land near Alewife Brook, east of Massachusetts Avenue (Tannery Brook con- nection),	15" pipe,	Aug. 23, 1896.
March 14, 1896,	Cambridge,	Pearl Street,	20" brick,	Aug. 31, 1896.
Sept. 5, 1896,	Melrose, .	Corner of Gould and Pleasant streets,	15" pipe,	Sept. 25, 1896.
Aug. 1, 1896,	Boston, .	About 200 feet south of shaft at the southerly end of siphon at man-hole in Alford Street, in the park,	15" pipe,	To be made.

The fifty-four connections made on this system to this date (Oct. 1, 1896) are distributed as follows: Arlington, two; Belmont, one; Boston, three; Cambridge, thirteen; Everett, two; Malden, four; Medford, eleven; Melrose, two; Somerville, three; Winchester, seven; Winthrop, three; and Woburn, three. The Board has authorized at this date nine connections, which have not been made as yet, distributed as follows: Boston: East Boston, two; Deer Island, one; Cambridge, four; Medford, one; Stoneham, one.

EXPENDITURES.

The expenditures upon this system, including all payments on account of contracts during the twelve months ending Sept. 30, 1896, amount to \$400,349.58. This, with the amount previously reported, \$4,556,204.92, makes the total expenditures to date \$4,956,554.50. Table D in the Appendix contains a full statement of the cost of operation for the year ending Sept. 30, 1896. Your attention is called to the tables submitted herewith for matters of detail.

CHARLES RIVER VALLEY SYSTEM.

The operation of this system has been constant during the year, and a full statement of the expenses is in Table E in the Appendix. The unexpended balance on Sept. 30, 1896, will, we estimate, be sufficient to meet operating expenses until such time as a new appropriation can be made therefor.

In our last annual report (Public Document No. 45, 1896), after outlining the negotiations then pending in relation to a new contract with the city of Boston, in relation to receiving sewage from the Charles River valley system, we say : —

On Saturday, Feb. 9, 1895, the superintendent of streets met the Board by appointment, and stated that the subject of receiving sewage from the Charles River valley system was being investigated, and would be reported upon at as early a day as possible. There the matter has rested, and negotiations are still pending, with this end in view.

In November, 1895, the Board addressed the following letter to the superintendent of streets of the city of Boston : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Nov. 30, 1895.

B. T. WHEELER, Esq., *Superintendent of Streets, City Hall, Boston, Mass.*

DEAR SIR : — Will you kindly meet this Board in consultation in relation to the contract for disposal of sewage from the Charles River valley system, through the Boston Main Drainage Works, with outlet at Moon Island, on Saturday next, December 7, at 10 o'clock A.M., at their office, No. 110 Boylston Street, Room 21?

For the Board,

Truly yours,
(Signed)

EDWARD P. FISK,
Clerk.

To this the following reply was received : —

STREET DEPARTMENT, CITY HALL,
OFFICE OF THE SUPERINTENDENT, ROOM 47,
BOSTON, Dec. 3, 1895.

Mr. EDWARD P. FISK,
Clerk Metropolitan Sewerage Commission, 110 Boylston Street.

DEAR SIR : — I will endeavor to be at your office Saturday next,
December 7, at 10 A.M., if possible.

Very truly yours,

(Signed)

B. T. WHEELER,
Superintendent of Streets.

On Dec. 7, 1895, as appointed above, B. T. Wheeler, superintendent of streets, and others of the city of Boston, held a consultation with the Board regarding the price to be paid Boston for receiving sewage from the Charles River valley system and disposing of the same at Moon Island for a period of five years (1896 to 1900 inclusive), but failed to reach any conclusion in the matter.

On Nov. 9, 1895, the following certificate had been sent to the Treasurer and Receiver-General : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Nov. 9, 1895.

To the Treasurer of the Commonwealth of Massachusetts.

The Board of Metropolitan Sewerage Commissioners, in pursuance of the requirements of section 13 of chapter 439 of the Acts of 1889, do hereby certify that they estimate the cost of the maintenance and operation of the system of sewage disposal for the cities of Boston, Newton and Waltham, and the towns of Brookline and Watertown (called by us the Charles River valley system), as follows : —

Item 1.	For the year 1896,	.	.	.	.	\$30,000 00
Item 2.	For the year 1897,	.	.	.	.	31,000 00
Item 3.	For the year 1898,	.	.	.	.	32,000 00
Item 4.	For the year 1899,	.	.	.	.	33,000 00
Item 5.	For the year 1900,	.	.	.	.	33,500 00

HOSEA KINGMAN,

TILLY HAYNES,

ALBERT F. NOYES,

Metropolitan Sewerage Commissioners.

(Signed)

By EDWARD P. FISK,

Clerk.

The officials of the city of Boston had been demanding more than \$60,000 annually for service which had been previously rendered for about \$25,000 annually, and at the meeting above referred to the superintendent of streets had agreed to review his figures and report to the Board upon the same, there being a wide discrepancy between his figures and the estimates of our engineer, as reported to the Treasurer and Receiver-General in the communication of Nov. 9, 1895. The following correspondence passed between the superintendent of streets and this Board in relation thereto:—

STREET DEPARTMENT, CITY HALL,
OFFICE OF THE SUPERINTENDENT, ROOM 47,
BOSTON, Jan. 4, 1896.

Metropolitan Sewerage Commission, 110 Boylston Street.

GENTLEMEN:— Since the hearing kindly accorded me before your Board in the matter of the rental to be paid by the State to the city of Boston for the use of its sewers and main drainage works, I have carefully reconsidered all the points made, as I promised, and beg to submit the following conclusions, in which I think I have yielded every point which I consistently could, and have practically covered, I believe, all of those objections which I understood your Board to make.

You will remember that, upon the basis of actual measurements taken, we estimated the flow of sewerage to be 20+ cubic feet per second, while your engineer, I believe, not from actual measurements, theoretically figured it to be 16+ cubic feet per second. I have since submitted to your Mr. Swan a calculation based upon the Board of Health's estimate of sewage and population, which makes the flow 18.6 cubic feet per second. As this has been in Mr. Swan's hands nearly two weeks, and as I have received no reply from him or you, although I have communicated with your Board by telephone regarding the matter, I assume that such a fair mean between your estimate and our measurement as this is, based upon such authentic sources, cannot help but meet with your approval. Upon this basis, the following tables show the sum to be paid the city by the State on the three following items:—

1. Maintenance.
2. Total expenditure at 3.987 per cent, consisting of two parts, viz.:—

Interest up to 1892,	\$1,204,932 12
Interest on expenditure since 1892, figured to 1896,	25,260 56
	<hr/>
	\$1,230,192 68

3. Interest at 3.987 per cent. on total expenditure to 1896.

Total expenditure to 1896, \$4,503,027 61

In tables A, B and C the amounts to be paid by the State are on the basis that the State pays for pumping the sewage of Brighton and part of Boston above Gainsborough Street. In tables D, E and F the amounts to be paid are on the basis that the State pays for pumping the sewage of the Charles River towns, exclusive of Brighton, and part of Boston above Gainsborough Street.

TABLE A. — *Maintenance.*

YEAR.	Total Gals. per Day to be pumped.	Total Gals. per Day to be pumped for State.	Ratio.	Cost per Million Gals. pumped Daily.	Total Cost of Pumping.	Amount to be paid by State.
1896,	67,200,000	12,800,000	4/21	\$1,551 18	\$104,239 30	\$19,855 10
1897,	71,700,000	13,500,000	45/239	-	111,219 61	20,940 93
1898,	76,100,000	14,200,000	142/761	-	118,044 80	22,026 76
1899,	80,600,000	14,900,000	149/806	-	125,025 11	23,112 58
1900,	85,100,000	15,700,000	157/851	-	132,005 42	24,353 53

TABLE B. — *Interest.*

YEAR.	Interest on \$1,230,192.68, at 3.987 Per Cent.	Ratio.	Amount to be paid by State.
1896,	\$49,047 78	4/21	\$9,342 43
1897,	-	45/239	9,234 94
1898,	-	142/761	9,152 15
1899,	-	149/806	9,067 14
1900,	-	157/851	9,048 77

TABLE C. — *Summary.*

YEAR.	Interest on \$4,503,027.61, at 3.987 Per Cent.	Ratio.	Amount to be paid by State.	Total of Items 1, 2 and 3.	Round-out of Items = Total Amount to be paid by State.
1896,	\$179,535 71	4/21	\$34,197 28	\$63,394 81	\$63,000 00
1897,	-	45/239	33,803 79	63,979 66	64,000 00
1898,	-	142/761	33,500 75	64,679 66	64,500 00
1899,	-	149/806	33,189 60	65,369 32	65,500 00
1900,	-	157/851	33,122 33	66,524 63	66,500 00

TABLE D. — Maintenance.

YEAR.	Total Gals. per Day to be pumped.	Total Gals. per Day to be pumped for State.	Ratio.	Cost per Million Gals. pumped Daily.	Total Cost of Pumping.	Amount to be paid by State.
1896, . . .	67,200,000	8,900,000	886/6,720	\$1,551 18	\$104,239 30	\$13,743 45
1897, . . .	71,700,000	9,300,000	932/7,170	-	111,219 61	14,456 99
1898, . . .	76,100,000	9,800,000	98/761	-	118,044 80	15,201 66
1899, . . .	80,600,000	10,300,000	103/806	-	125,025 11	15,977 15
1900, . . .	85,100,000	10,700,000	107/851	-	132,005 42	16,597 63

TABLE E. — Interest.

YEAR.	Interest on \$1,230,192.68, at 3.987 Per Cent.	Ratio.	Amount to be paid by State.
1896,	\$49,047 78	886/6,720	\$6,466 72
1897,	-	932/7,170	6,375 52
1898,	-	98/761	6,316 27
1899,	-	103/806	6,267 89
1900,	-	107/851	6,166 99

TABLE F. — Summary.

YEAR.	Interest on \$4,503,027 61, at 3 987 Per Cent.	Ratio.	Amount to be paid by State.	Total of Items 1, 2 and 3.	Round-out of Items = Total Amount to be paid by State.
1896,	\$179,535 71	886/6,720	\$23,670 93	\$43,881 10	\$43,500 00
1897,	-	932/7,170	23,337 14	44,169 65	44,000 00
1898,	-	98/761	23,120 24	44,638 07	44,500 00
1899,	-	103/806	22,943 15	45,188 19	45,000 00
1900,	-	107/851	22,573 82	45,338 44	45,500 00

You will note that I have submitted two estimates, because of the fact that, since our last interview, your Mr. Brown has stated that a portion of the previous rental paid was assessed back upon the city, of which we were unaware, and because our previous estimate made to you this year did not include the total area drained by the metropolitan system, but excluded Brighton and the part of Boston above Gainsborough Street. I cannot understand how this could have been the case, since I supposed all previous figures made to have been upon a district which did not include these parts of Boston. If the rental, therefore, is to

include all areas entering into the metropolitan system, and thence into our main drainage works, the rental we ask will be the larger figures named. If the rental is to be for the territory outside of Boston entering the metropolitan system, and thence our main drainage works, the rental will be the smaller figures.

I think that, with a feeling of perfect fairness, I have yielded all those points which I can; and in regard to some of your claims made at our interview, I wish to say that the corporation counsel informs me that at the time when the city agreed to the previous rental it was distinctly understood between the commissioners, Mr. Carter and himself that the rental then charged was not an adequate one, and was not to serve as any precedent. The city yielded its claims to increase from the fact that the commission stated at that time that it had made its estimate to the auditor, and would be much embarrassed by an increase.

With regard to your claim that the rates of interest at which the State could have hired money at the time when the city made loans to build this plant were less than those actually paid by the State, I find that this has no great foundation, since in 1875, 1876 and 1877 the State paid 5 per cent. upon its bonds, and is now paying 3 and $3\frac{1}{2}$ per cent.

Regarding your statement that the State could, and might, take the plant belonging to the city, and that, if it did so, the amount paid therefor would not be the cost of that plant to date; that it had unquestionably deteriorated; and that it could be built to-day for a less sum than it originally cost, — I have nothing to say, except that I know of no facts to bear out this statement; and if the State chooses, rather than pay what appears to me to be a fair rental, to take the plant, as the commission has intimated, I am of the opinion (and the corporation counsel coincides with me in this) that the payment to be made therefore by the State will not differ materially from the cost of said plant to the city of Boston.

Very truly yours,

(Signed)

B. T. WHEELER,
Superintendent of Streets.

To this the following reply was mailed : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Jan. 11, 1896.

B. T. WHEELER, Esq.,

Superintendent of Streets, Boston, Mass.

DEAR SIR: — Your communication of Jan. 4, 1896, to the Metropolitan Sewerage Commissioners, relating to their contract with the city of Boston for disposal of sewage from Charles River

areas, through Boston main drainage works, was this day considered. In reply, it is desired to state that in the matter of flow of sewage under consideration you appear to misunderstand the facts. The estimate of 16 cubic feet per second by our engineer was based upon actual measurements extending over a considerable period of the spring of 1894. Your estimate of 20 cubic feet per second, we understand, was obtained from measurements of a few hours, extended to cover a single day, from ratios obtained from the actual measurements of our engineer, as set forth in report to you from H. W. Sanborn, deputy superintendent sewer division, dated Nov. 11, 1895. Measurements for so short a time and made possibly under unusual conditions of flow could not equitably be applied to flows extending over a whole series of years.

In relation to your second estimate of flow of 18.6 cubic feet per second, the facts are as follows: your Mr. Dorr had an interview with our engineer about Dec. 19, 1895, in relation to the proposed study, in which a variety of allowances and uses of the sewers was considered. The result of this interview was that your Mr. Hamilton was to carry out a series of calculations, on the completion of which a conference was to be had between your engineer and our own. Our Mr. Swan met your Mr. Hamilton December 20 in relation to the calculations. We were notified by telephone December 31 that your people were prepared for a conference, and a conference was arranged for your Mr. Dorr at the office of our engineer, Jan. 3, 1896. He, however, failed to appear, and no further appointment had been made prior to the receipt of your communication of Jan. 4, 1896.

Your second estimate of flow, based upon the State Board of Health's estimate of sewage and population, giving 18.6 cubic feet per second, is regarded by us as being worthy of detailed examination. This method, as we understand it, was based upon the estimated average water consumption, to which was to be added for ground water, etc., an amount estimated at 52 gallons per day per inhabitant. This amount is regarded by us as excessive, for the following reasons: —

In the report of the State Board of Health, from which your estimate was derived (viz., report of January, 1889, Senate No. 2), on page 92 is an estimate of the average rate of flow of sewage per inhabitant in Boston, as follows: —

	Gallons.
Sewage equal to the water supply,	90
Sea-water leakage,	8
Sea-water leakage from sugar refinery,	4
Ground water,	45
	<hr/>
	147

It appears to us, therefore, that your figure for ground water, etc. (viz., 52 gallons), must include about 7 gallons of sea water, which is nearly equal to the amount of sea-water leakage in the above estimate. Now, it is evident that the opportunity for the leakage of sea water in the case of the sewers in the Charles River valley is very much less than it is in the case of the sewers in Boston, since the greater part of the territory in the former case is above the level of the sea. Moreover, we are of the opinion that the amount of leakage of ground water proper in the Charles River valley district is less than it is in Boston, for the reason that special provision has been made in some parts of said valley to reduce the level of the ground water.

For these reasons it appears to us that the estimate for ground water, etc., should be reduced say to 45 gallons per inhabitant per day, as in the above estimate. With this amount the estimated daily average flow of sewage is about 3.4 per cent. more than the estimate formerly made by this Board for the period under consideration. The estimate of population of the Metropolitan Water Board is about 10 per cent. greater than the estimate made by the Board for the period under consideration. These two percentages when combined indicate that an increase of about 13.74 per cent. over the estimate of sewage made by this Board would result from using this method, here suggested, based upon 45 gallons per inhabitant per day in addition to the estimated daily average water consumption.

We are still of the opinion that interest charges should be shared on the use of the system. The Charles River main is designed and used for foul drainage only. The very careful study of the State Board of Health (see report, January, 1889, Senate No. 2, page 97) indicates that fully 50 per cent. of the capacity of the trunk sewer and outfall works of Boston main drainage have been, and for the coming thirty years probably will be, devoted to storm-water relief for city of Boston areas. Under these conditions it has seemed to us that the Charles River area should pay their proportional part of interest charges on only 50 per cent. of the cost of the works, and the Commonwealth should not pay for the use of the city sewer and outfall works any sum by way of interest on such sum of money as the city has paid by way of interest on the money it borrowed to construct the sewer and outfall works.

You suggest that the cost to the Charles River areas could not be less than the amounts arrived at in your study, if the Sewerage Commission should acquire and operate the works. A hasty study has been prepared to indicate costs to Charles River areas on the basis of last award of apportionment commission, as follows:—

COMBINED WORKS, — CHARLES RIVER VALLEY SEWER AND BOSTON
MAIN DRAINAGE.

Proportions based upon Valuations of 1895.

CITY OR TOWN.	Estimated Valuations.*	ESTIMATED PROPORTIONS.†	
		Combined District as a Whole.	As between the Present Charles River Valley Group and the Boston Main Drainage.
		Per Cent.	Per Cent.
Boston,	\$914,214,378	86.83	{ B.M.D. } 81.33
Brookline,	66,550,308	6.28	{ C.R.V. } 5.00
Watertown,	8,706,146	0.82	{ C.R.V. } 6.28
Newton,	49,969,044	4.72	{ C.R.V. } 0.82
Waltham,	19,584,719	1.85	{ C.R.V. } 4.72
			{ C.R.V. } 1.85
	\$1,059,024,595	100.00	100.00

* Of districts tributary to Charles River valley sewer and Boston main drainage.
† In which the several cities and towns may be called upon to pay money to meet interest and sinking fund requirements.

Proportions based upon Populations of 1895.

CITY OR TOWN.	Estimated Populations.*	ESTIMATED PROPORTIONS.†	
		Combined District as a Whole.	As between the Present Charles River Valley Group and the Boston Main Drainage.
		Per Cent.	Per Cent.
Boston,	405,936	84.86	{ B.M.D. } 78.59
Brookline,	16,159	3.38	{ C.R.V. } 6.27
Watertown,	7,788	1.63	{ C.R.V. } 3.38
Newton,	27,622	5.77	{ C.R.V. } 1.63
Waltham,	20,677	4.36	{ C.R.V. } 5.77
			{ C.R.V. } 4.36
	478,382	100.00	100.00

* Of districts tributary to Charles River valley sewer and Boston main drainage.
† In which the several cities and towns may be called upon to pay money to meet cost of maintenance and operation.

Maintenance.

YEAR.	Total Gals. per Day to be pumped. (Street Dept.)	Total Cost of Pumping, etc., B.M.D. (Street Dept.)	Cost of Maintenance, Charles River Valley Sewer.	Total Combined Maintenance.
1896,	67,260,000	\$112,600 99	—*	—*

* The cost of maintenance of Charles River valley sewer is offset by the cost of maintenance of the branch intercepting sewers in Boston, which is understood to be included in column 3.

YEAR.	Ratio for Charles River Valley Group.	Amount to be paid by Charles River Valley Group.
	Per Cent.	
1896,	21.41	\$24,107 87
1897,	21.41	25,722 23
1898,	21.41	27,300 73
1899,	21.41	28,915 09
1900,	21.41	30,529 46

The Charles River valley group comprises Waltham, Newton, Watertown, Brighton, Brookline and “ part of Boston.”

The amounts given in the estimates received from the Boston street department, sewer division, are assumed to be correct for the purposes of this table.

The estimated annual cost of maintenance, interest and sinking fund for the Charles River valley sewer is \$30,670.39.

TABLE 1b.

YEAR.	Payments to Interest and Sinking Fund.*	Payments to Metropolitan Sewerage.†	Total Payments Interest and Sinking Funds.	Ratio for the Charles River Valley Group.
				Per Cent.
1896,	\$179,415 00	\$25,670 39	\$205,085 39	18.67
1897,	179,415 00	25,670 39	205,085 39	18.67
1898,	179,415 00	25,670 39	205,085 39	18.67
1899,	179,415 00	25,670 39	205,085 39	18.67
1900,	179,415 00	25,670 39	205,085 39	18.67

* On account of estimated cost of purchase of portions of the Boston main drainage, \$4,500,000 at 3.987 per cent.
† Interest and sinking fund for Charles River valley sewer, \$769,726.72 at 3.335 per cent.

YEAR.	AMOUNTS TO BE PAID BY THE CHARLES RIVER VALLEY GROUP.			Amounts.*
	For Interest and Sinking Fund.	For Maintenance.	Total.	
1896,	\$38,289 44	\$24,107 87	\$62,397 31	\$31,726 92
1897,	38,289 44	25,722 23	64,011 67	33,341 28
1898,	38,289 44	27,300 73	65,590 17	34,919 78
1899,	38,289 44	28,915 09	67,204 53	36,534 14
1900,	38,289 44	30,529 46	68,818 90	38,148 51

* After deducting \$30,670.39 from the total and equivalent to a rental to be paid city of Boston.

The amounts are some \$30,000 per year less than your figures, and it is not unlikely that an apportionment commission might still further reduce them on account of Boston storm-water uses of the outfall works.

In regard to your doubt whether a portion of the cost of maintenance of the Charles River system is assessed back upon the city, we beg leave to refer you to page 36 of our fourth annual report, on which is a table giving the award of the first board of apportionment. The proportion of the expense for maintenance to be paid by the city of Boston for "Brighton and part of city proper" is there given as 25.05 per cent. of the whole cost of maintenance, which, of course, includes any rental paid by the Commonwealth to the city of Boston for disposing of the sewage. This is further made evident by the State Auditor's report for January, 1896, where, on page 137, it is seen that the city of Boston paid \$6,763.50 in a total of \$27,000 on account of Charles River system of sewage disposal maintenance. In regard to your contention that the rental formerly agreed upon was considered at the time to be inadequate, and that it was not to serve as a precedent, we beg to say that we understand such is not the fact. There was no contention as to the amount of yearly rental to be paid for the first three years. These amounts were agreed upon as the result of computations made by Mr. Carson and Mr. Carter. As to the yearly rental for the last year of the four years, Mr. Carter thought that, because of the increased amount of sewage which would probably be discharged that year from the Charles River system, the sum of \$24,000 might perhaps not be sufficient, and reserved the right to increase that amount if, before the final execution of the contract, he should become satisfied that said sum was too small. No change in the amount was made, and the contract was executed with the city for that amount. There was no understanding on the part of the commission that the rental charged for those years was not adequate, nor that the same was not to serve as a precedent. The city did not then claim any increase except as already stated above.

For the Board,

Truly yours,

(Signed)

EDWARD P. FISK,

Clerk.

To the foregoing the following reply was received : —

STREET DEPARTMENT,
OFFICE OF THE SUPERINTENDENT, ROOM 47,
CITY HALL, BOSTON, Jan. 15, 1896.

Metropolitan Sewerage Commission, 110 Boylston Street.

GENTLEMEN : — I beg to acknowledge the receipt of your communication of January 11, in reply to mine of January 4, and I trust I shall be excused for saying that you appear to shift your

ground in this matter as fast as your position seems vulnerable. This I admit to be good generalship, but it will not lead, in my judgment, to any agreement between us.

I wish also to add that two statements which I made in my communication referred to, in support of which I can bring witnesses, are stated courteously by you not to be facts. Your mere statement to the contrary does not bear any more weight with me than the testimony of my witnesses; and I trust the last clause of my letter of the 4th instant will excuse me from any further discussion, and be considered final.

I must also call your attention to two statements in your letter, one of which implies that the leakage of your system is very small, the reasons advanced being the fact that much the greater part of its territory is above the level of the sea, that the ground-water leakage is specially provided against, and the assumption of superior construction of your sewers. A large portion of your Charles River valley system is below the sea level, running through salt-marsh lands. I know of no special provision (of which you speak) in the matter of ground water unless you refer to the Noyes system of underdrainage, which I understand you have in some portion of Newton, and which I do not wish to criticise, except that it unquestionably gives a head to the ground water, and may perhaps be the cause of increased rather than diminished leakage.

After your system was constructed and before any connections had been made with it, there was a considerable flow through it, due to leakage entirely. I think my sewer division officials have some data in regard to the amount of this, number of cubic feet per second, and, if so, they will gladly hand this to you, if you are not already in possession of it. From this it would appear that your system was no more perfectly constructed in this regard than others.

You state that your Mr. Swan met my Mr. Hamilton December 20 in relation to calculations which I submitted for your approval or rejection, that you were notified by telephone December 31 that I was prepared for a conference, that a conference was arranged for Mr. Dorr at the office of your engineer January 3, that he failed to appear, and that no further appointment was made previous to the receipt of my communication of January 4. I desire for personal reasons to set Mr. Dorr right in this matter, and to say that no communication was received from any of your people after the conference between Mr. Swan and Mr. Hamilton; that, because of this, I personally called up your office twice, requesting that Mr. Swan return the study with any comments which he might

have to make, or with the approval of the Board ; and that no conference was arranged for Mr. Dorr on January 3, or at any other date after December 20, either by Mr. Hamilton, Mr. Dorr, Mr. Sanborn or myself, or by any other person whatsoever, so far as I am able to discover.

Very truly yours,

(Signed)

B. T. WHEELER,
Superintendent of Streets.

The late Governor, Frederic T. Greenhalge, in his inaugural address to the Legislature of 1896, speaks thus of —

Metropolitan Sewerage.

Since last January negotiations have been pending between the city of Boston and the Board of Metropolitan Sewerage Commissioners with a view to fixing upon the yearly rental value of the trunk sewer, pumping station and outfall of the Boston improved system for the use of our Charles River system, for a term of five years. It was hoped that some agreement might be reached. During the last five years the Commonwealth has paid the city of Boston for this use an average yearly rental of about \$26,000, but now the city of Boston asks about \$52,000 per year for the next five years. Under the statutes the Commonwealth can, by the exercise of the right of eminent domain, take the right to use the trunk sewer and leave the question of rental to be determined by the courts or otherwise. The same question will arise when it becomes necessary to use the Neponset valley sewer, which is soon to be constructed. It would be well to consider whether it would not be economy and good policy for the Commonwealth to take the main trunk sewer of the Boston improved system, from the point in Huntington Avenue where the metropolitan sewer connects with it to the pumping station, and take the pumping station and outfall sewer now belonging to the city of Boston as a part of the metropolitan system, and have the same thereafter maintained and operated by the Commonwealth.

There may be some question whether chapter 439 of the Acts of 1889 is broad enough in its terms to confer upon the commission the authority to take the pumping station and outfall sewer ; therefore, if it should seem best to pursue this course, such legislation should be had as would give the power and provide the funds.

The above paragraph, as well as the annual report of this Board (Public Document No. 45, 1896), was referred by the Legislature to the committee on metropolitan affairs,

and a hearing was appointed to this Board on Jan. 27, 1896, regarding the same. The question of the trunk line of the Boston main drainage system being taken by the Commonwealth and incorporated as a part of the metropolitan sewerage system was held pending further investigation. On Jan. 29, 1896, the following communication, which is self-explanatory, was addressed to the committee and sent to its chairman :—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Jan. 29, 1896.

To the Committee on Metropolitan Affairs,

Hon. CHARLES F. SPRAGUE, *Chairman.*

After our meeting with you Monday, on talking the matter over together we found that there was some misunderstanding as to the question of whether this Board desired legislation; also as to whether our report asked for legislation. It is claimed that our chairman stated that our report asked for legislation as to the matters hereinafter stated. If he did so state, it was error and must have misled you. Our report speaks as of Sept. 30, 1895, but since that time conditions have changed somewhat, and we now feel that it is of importance to the cities and towns of the Charles River and Neponset valley systems that the main trunk sewer of the Boston main drainage system, from the point at Gainsborough Street, in Huntington Avenue, where the Charles River system sewer now connects with the main drainage system, to its outlet of discharge at Moon Island, the pumping station, storage basins and discharge plant and sewers, should be taken, controlled and operated by the Commonwealth, the cities and towns using the sewer and benefited thereby to pay therefor the fair market value of the property. For the past four years the Charles River system has been paying to the city of Boston for the use of said property rental at the rate of \$23,000 for the first three years and \$24,000 for the last year. This was done under an agreement which terminated Dec. 31, 1895. Early in 1895 negotiations were commenced for the purpose of determining rental for said property for a year or term of years, and as yet without definite result. The city of Boston claims something over \$63,000 as a fair price for yearly rental of said property. Under the original act, 1889, chapter 439, the Commonwealth has the right to take the use of the sewers of the Boston main drainage system and have the sewage of the Charles River system discharged through said pumping station and said outlet at Moon Island, paying therefor such price as may

be determined by the courts or otherwise. The Neponset valley sewer must when completed also discharge into the main drainage system, and must also pay tribute to the city of Boston for the use of said property. Then we will have two systems of sewers belonging to the Commonwealth dependent upon the city of Boston and its operation and care of said property for the disposal of sewage, with every little while a question of contract or taking of the right to use said property to be open for discussion, settlement and possibly litigation. It would seem to be economy for the Commonwealth to take and own said property, as it is likely it would cost the several cities and towns less to hire the money of the Commonwealth for the purchase of said property and pay interest thereon than to pay any such sum as the city of Boston is now asking for yearly rental. If said property were so taken the expense thereof would (or could, under proper legislation) be apportioned upon the several cities and towns benefited, and so all (including Boston) bear the burden equitably and fairly. We deem the matter of sufficient importance to call your attention to it, inasmuch as the recommendations and plans of the State Board of Health referred to in said act of 1889 clearly contemplate the use of said property by said Charles River valley system and the disposal of its sewage thereby; and yet the terms of said act (it seems to us) are hardly broad enough to justify the taking of said property by the Commonwealth, and no appropriation large enough to meet such expense has ever been made.

By the last Legislature an act (1895, chapter 406) was passed authorizing this Board to construct a sewer for the Neponset River valley, and the sum of \$500,000 appropriated therefor. Studies and plans for the work have been made and submitted to the State Board of Health, as required by the act. From these studies and plans it is estimated by our Board that the work will cost \$675,726 (see our report, page 49). We call attention to this, not that we think it will be necessary to make an additional appropriation for this purpose this year, as the present appropriation will probably be sufficient for all the work we can accomplish in this direction this year, but that you may have a full understanding of the situation.

Very respectfully,

BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS,

(Signed)

HOSEA KINGMAN,

Chairman.

Hon. Josiah Quincy, having succeeded Mayor Curtis as mayor of Boston, appointed Benj. W. Wells successor to

B. T. Wheeler as superintendent of streets, and on Feb. 19, 1896, the following communication was sent to the mayor by order of the Board :—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Feb. 19, 1896.

HON. JOSIAH QUINCY,

Mayor of the City of Boston, City Hall, Boston, Mass.

DEAR SIR :— On Jan. 19, 1895, this Board addressed a communication to your predecessor, calling attention to the fact that a contract made between the Commonwealth and your city in 1892 for disposing of sewage from the Charles River valley system of the metropolitan sewerage through the Boston main drainage works expired with the year 1895, and asking that some one be designated to act for the city in relation to a new contract. In answer, Mr. Wheeler, the late superintendent of streets, was named, and negotiations were pending at the time of his retirement. Mr. Wheeler had had several consultations with this Board, but no agreement had been reached, and, as this Board desires an early settlement, will you kindly designate some one to meet us in relation thereto, that the matter may be speedily adjusted?

For the Board,

Yours very truly,

(Signed)

EDWARD P. FISK,

Clerk.

The following was received in reply :—

STREET DEPARTMENT, CITY HALL,
OFFICE OF THE SUPERINTENDENT, ROOM 47,
BOSTON, March 23, 1896.

Metropolitan Sewerage Commission, 110 Boylston Street.

GENTLEMEN :— Your letter of February 18 to His Honor the mayor, in reference to contract between the Commonwealth and the city of Boston for disposing of sewage from the Charles River valley system of metropolitan sewerage through the Boston main drainage works, has been referred to me for action. I have placed the matter in the hands of Mr. Nathan S. Brock, the engineer of construction of this department, and I should be pleased to hear from you in regard to such further arrangements as may lead to an early settlement.

Yours very truly,

(Signed)

BENJ. W. WELLS,

Superintendent of Streets.

After further correspondence an appointment was made for Mr. Brock to meet this Board in consultation on April 11, 1896, at which time said meeting was held, and the matter of determining the relative flow in the Charles River valley sewer was referred to the engineering department of this Board, to act in concert with the street department of the city of Boston, and report later.

In answer to a request of the committee on metropolitan affairs for a bill authorizing the Commonwealth to acquire the Boston main drainage system by purchase or otherwise, and making appropriation therefor, the following was submitted to the chairman : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, March 18, 1896.

HON. CHARLES F. SPRAGUE,

Chairman Committee on Metropolitan Affairs,

State House, Boston, Mass.

DEAR SIR : — I enclose the draft of an act prepared by this Board, covering the recommendations made by His Excellency in his annual message to the Legislature, regarding the Commonwealth's acquiring the Boston main drainage system.

Will your committee kindly authorize the same to be printed for use, so that copies may be furnished to parties interested?

For the Board,

Very truly yours,

(Signed)

EDWARD P. FISK,

Clerk.

The act alluded to followed in general the provisions of chapter 406, Acts of 1895, with such alterations as were necessary to adapt it to the circumstances for which it was intended. By the committee's directions one hundred copies were printed for its use, some of which are now accessible. Early in April, at a hearing appointed by the committee on the proposed bill, a verbal agreement was entered into between this Board by its chairman and the city of Boston by its corporation counsel, with the approval of the mayor, to make the amount \$27,000, to be paid said city for receiving sewage from the Charles River valley system at the connection between said system and its main drainage line

at Huntington Avenue and Gainsborough Street, Boston, and discharging the same at its outlet at Moon Island during the year 1896, the payments to be made in quarterly instalments, as under the previous contract; and, pending the investigation previously referred to regarding the flow in the Charles River valley sewer, the paragraph of the governor's address above quoted was referred to the next General Court by the Legislature then in session.

This Board has not as yet received any formal report from the city of Boston regarding the question then pending, but understands that the results of the investigation indicate that a saving of several thousand dollars annually would be made to said city by the Commonwealth's taking and acquiring the trunk line of the Boston main drainage system, and incorporating it as a part of the metropolitan sewerage system. We would respectfully ask, therefore, that the matter referred to your honorable body by its predecessor be considered and favorably acted upon.

The following settlements for land taken upon this system have been made during the year: by deed dated April 3, 1896, Mary E. Emerson, administratrix and heir-at-law of the estate of Matilda Emerson of Newton, quit-claimed to the Commonwealth "rights, privileges and easements" in land in Newton, included in a taking dated March 7, 1891, and recorded in Middlesex South District Registry, book 2030, page 121. The deed from the said Emerson is recorded with Middlesex South District Registry, book 2457, page 565. Damages sustained to land in Brighton and Newton, belonging to John E. Cassidy, included within a taking dated March 7, 1891, and recorded in Suffolk Registry of Deeds, book 1987, page 3, and also in Middlesex South District Registry, book 2030, page 121, were paid by the Commonwealth upon an execution issued from the superior court; and Walter U. Lawson of Newton was similarly satisfied for land in Newton taken under the aforesaid taking.

This leaves the following cases on this system still pending in court at this date (Oct. 1, 1896): Suffolk County, Butchers' Slaughtering and Melting Association; Middlesex County, Albert Breckett, Newton.

Connections made with the Metropolitan Sewer in the Charles River Valley from Oct. 1, 1895, to Sept. 30, 1896.

DATE AUTHORIZED.	City or Town.	Location of Connection.	Size.	Date of Completion.
Oct. 26, 1895, .	Newton,	In garden of Sarah M. L. Bates, near Hyde Brook.	5 inch,	Nov. 4, 1895.
May 2, 1896, .	Newton,	In land of estate of Matilda Emerson, east of Hyde Brook.	6 inch,	May 18, 1896.

These, with the connections previously reported, show thirty-five connections made with the metropolitan sewer by the towns and cities embraced within this system, which are distributed as follows: Boston, nine; Brookline, one; Boston (Brighton), twelve; Watertown, four; Newton, eight; Waltham, one; total, thirty-five.

WATERTOWN SIPHON.

The following letter received by the Board was referred to the engineer at its meeting held Feb. 1, 1896:—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN PARK COMMISSION, ENGINEERING DEPARTMENT,
13 EXCHANGE STREET, BOSTON, Jan. 31, 1896.

HOSEA KINGMAN, TILLY HAYNES, ALBERT F. NOYES,
Metropolitan Sewerage Commissioners.

GENTLEMEN:—In compliance with the instructions received from a committee appointed by the town of Watertown to consider the matter of sewers for the eastern part of the town, I would respectfully request your consideration of the following: the original plan for sewerage of this portion of the town contemplated a trunk sewer through a part of Arlington Street, across the arsenal grounds and under the Charles River to a connection with the trunk sewer of the Charles River system. This method would necessitate a long trunk sewer at great expense through a district at present very thinly settled, and which would not require a sewer for many years. A much less expensive system, and one which would meet the needs of district more fully, would be an outlet into the north metropolitan system through a connection with the Cambridge sewers at a point about six hundred feet northerly of the Mount Auburn Street bridge over the Watertown branch of

the Fitchburg Railroad, where the sewer in Holworthy Place crosses the tracks of this railroad. The extreme area which could possibly be drained to this connection from Watertown is about four hundred acres. The present actual needs of the district cover a much smaller area, but, with the widening of Mount Auburn Street in conformity with the order of the county commissioners, nearly the whole of the district comprised in the area given above will undoubtedly soon require sewers.

This committee, of which I am a member, desires, if possible, your approval of this method of sewage disposal for this section of Watertown into the north metropolitan system.

Very respectfully yours,

(Signed)

WM. T. PIERCE,

For the Watertown Committee on Sewers.

The engineer reporting on February 3, the following was sent : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, Feb. 3, 1896.

WM. T. PIERCE, Esq., *Watertown Committee on Sewers,*
13 Exchange Street, Boston, Mass.

DEAR SIR : — Your communication of Jan. 31, 1896, in relation to sewage disposal for four hundred acres in the easterly part of Watertown (through city of Cambridge sewers) into the north metropolitan system, was considered by the Board at its annual meeting to-day.

The engineer to the Board reports that, on account of excellent railroad connections and the activity of land development, a population of eight thousand to ten thousand may be anticipated in the near future upon the four hundred acres considered. Drainage from this population would be delivered into the westerly end of our Cambridge branch, which is only twenty-seven by twenty-eight inches in diameter, and designed none too liberally for an anticipated population of thirteen thousand from the Lowell Street area of Cambridge in 1930. The addition of drainage from a population of ten thousand people would reduce the life of the Cambridge branch at least ten years.

The Board is not prepared to recommend a project which so seriously cripples the branch. The present actual needs of your district, covering say thirty acres, with an anticipated population of six hundred to seven hundred and fifty people, would not seriously reduce the life of the metropolitan branch. The Board is,

however, of the opinion that chapter 439 of the Acts of 1889 does not give authority to deflect even this small amount of drainage from the Charles River to the north metropolitan system.

For the Board,

(Signed)

EDWARD P. FISK,

Clerk.

On April 22, 1896, a member of the Watertown sewer committee held a consultation with the Board regarding the aforesaid connection with the north metropolitan system, which resulted in the engineers being directed to make an estimate of cost of a siphon across Charles River for connection with the Charles River system, as originally designed; and on May 23 he presented to the Board his report, estimating the cost of said siphon to be about \$9,200.

The engineering department had prepared plans for the siphon, and upon Sept. 5, 1896, the Board signed an application to the Harbor and Land Commissioners of the Commonwealth for the approval of said plans, and authorized the chairman in behalf of the Board to sign a petition to the Honorable Secretary of War at Washington, D. C., asking his approval also; which was done and duly mailed.

At the meeting of the Board on Sept. 12, 1896, the following communication was submitted:—

Boston, Sept. 11, 1896.

Metropolitan Sewerage Commissioners,

1 Mount Vernon Street, Boston, Mass.

GENTLEMEN:—At a regular meeting of the Watertown sewer committee it was unanimously voted to request the Metropolitan Sewerage Commissioners to take the necessary land through the property of the Butchers' Slaughtering and Melting Association, and also build the siphon sewer under the Charles River from the Brighton shore to the Watertown shore, with suitable masonry structures on either shore.

If you will forward to the committee properly approved vouchers for labor and supplies for this work, they will be paid from our appropriation.

Yours truly,

(Signed)

H. H. SAWYER,

Chairman Watertown Sewer Committee.

The engineer was authorized to proceed with the work of constructing the siphon at East Watertown upon receipt of licenses from the authorities in Washington, D. C., and the Harbor and Land Commissioners of the Commonwealth, which have not been received at this date (Oct. 1, 1896).

EXPENDITURES.

The expenditures upon this system, including all payments on account of contracts during the twelve months ending Sept. 30, 1896, but not including expenses of operation (which are particularly stated in Table E of the Appendix), amount to \$52,831.53. This, with the amount previously reported, \$735,965.78, makes \$788,797.31 as the total expenditures to date.

Your attention is called to tables submitted herewith for matters of detail.

NEPONSET RIVER VALLEY SYSTEM.

At the time of the last annual report of this Board notice had been received that the act (chapter 406, Acts of 1895) authorizing the construction of this system had received the approval of the Executive; the plan and report of our chief engineer had been approved and adopted and sent to the State Board of Health for approval, but no report had then been received from said Board. This Board, at its meeting on Feb. 29, 1896, had the following communication submitted to it:—

OFFICE OF STATE BOARD OF HEALTH,
STATE HOUSE, BOSTON, Feb. 18, 1896.

To the Metropolitan Sewerage Commissioners, Boston, Mass.

GENTLEMEN:—The State Board of Health has considered your application with reference to a proposed system of sewage disposal for that portion of the city of Boston and the towns of Milton, Hyde Park and Dedham lying within the valley of the Neponset River, and portions of the city of Newton and the town of Brookline lying within the valley of the Charles River. The application

is accompanied by a plan and profiles and a report of your engineer giving details of the proposed scheme approved and adopted by your Board in accordance with a provision of chapter 406 of the Acts of 1895.

The plan provides for a main sewer from a point on Worley Street, near Weld Street, in the West Roxbury district of the city of Boston, through various streets and private lands to the bank of the Charles River, a short distance above the Brookline water works pumping station, thence in the vicinity of the right bank of the Charles River and along the left bank of Mother Brook and the Neponset River to the Dorchester intercepting sewer of the city of Boston at Central Avenue in Dorchester. The capacity of the latter sewer is limited by a section below Baker's Court in Dorchester, which has a capacity of only about twenty cubic feet per second, and it is estimated that the capacity of this sewer, if the sewage of the Neponset valley is discharged into it, will be attained about the year 1905. To provide for the disposal of the sewage after this date two methods are suggested, by either of which the sewage in the Neponset intercepting sewer would be diverted at a point on River Street, Hyde Park, about 500 feet below the Mattapan paper mill, and conveyed by gravity either to the Boston main drainage sewer at Squantum or an independent outlet at Nut Island in Quincy. With this end in view the Neponset intercepting sewer has been designed, with a capacity above the point of diversion estimated to be sufficient for the probable needs of the valley until 1930, while below this point the capacity is proportioned to that of the limiting section of the Dorchester intercepting sewer, estimated to be sufficient until 1905.

In designing the Boston main drainage system it was anticipated that the sewage from the higher portions of the district bounded by the Charles River, Mother Brook and the Neponset River could be at some future time intercepted by a "high-level" sewer and conveyed to Squantum by gravity, thus affording relief to the pumping station and tunnel when the flow of sewage shall tax their capacity, and provision was made in the construction of the works for the connection of such a sewer with the outfall works at Squantum and Moon Island. Your investigations indicate that a feasible route for this sewer can be found, which would intercept the proposed Neponset valley sewer at the point where its size is reduced, on River Street in Hyde Park. Your investigations also indicate that a feasible route for an intercepting sewer from this point to Nut Island may also be found. With regard to disposing of the sewage in the future by either of these methods the Board can express no opinion with the information available at the pres-

ent time, and you have verbally requested that the consideration of these matters be omitted. The Board has accordingly considered only that portion of your application which refers to the disposal of the sewage of the Neponset valley by means of the proposed sewer shown on the plan contained in the seventh annual report of your Board, opposite page 38, which provides for the discharge of the sewage into the Dorchester intercepting sewer at Central Avenue in Dorchester.

With regard to this portion of the scheme, the Board finds that the proposed sewer will provide a satisfactory means of disposal for the sewage of the territory in the Charles and Neponset valleys which it is estimated to serve, probably until about the year 1905, if care is taken in the construction of the main sewer and tributary systems to exclude surface and ground water from the sewers so far as possible, and if the amount of manufacturing sewage is restricted by preventing the discharge into the sewer of water from manufacturing establishments that can be properly discharged into natural water courses.

The size of the proposed sewer above the point where it is expected that the sewage will be diverted at some future time appears to be sufficient to make a reasonable provision for a population as great as may be expected to be connected with this portion of the system in 1930, so far as can be judged by present indications. The size of the sewer below the point where it is expected that the sewage of the Neponset interceptor may be diverted is such as to serve the low districts in Dorchester and Milton for many years after the sewage of the upper portion of the system is diverted.

The Board approves the plan of disposing of the sewage of the Neponset valley by discharging it into the Dorchester intercepting sewer of the city of Boston, but expresses no opinion as to the most appropriate method of disposal to adopt after the capacity of this sewer is reached. The increase in the amount of sewage to be disposed of by the Boston main drainage system will necessitate before long the enlargement of the reservoir capacity at Moon Island, and the necessity for enlargement will be hastened by the addition of the Neponset valley sewage.

It is understood that the sewerage systems to be connected with the Neponset valley sewer shall be constructed upon the so-called "separate" plan, and that no sewage overflows will be used in connection with the main sewer or tributary systems.

By order of the Board,

(Signed)

SAML. W. ABBOTT,

Secretary.

To this the following reply was sent : —

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, March 18, 1896.

To the Honorable the State Board of Health, State House, Boston, Mass.

GENTLEMEN : — In your reply of Feb. 18, 1896, to our application for approval of plans for sewage disposal for Neponset River valley, at the close you say : “ It is understood that the sewerage system to be connected with the Neponset valley sewer shall be constructed upon the so-called ‘ separate ’ plan, and that no sewage overflows will be used in connection with the main sewer or tributary systems.” As we are informed and understand, you do not by the use of the words “ no sewage overflows will be used,” etc., intend to prohibit or prevent the construction of such provision for temporary overflows as it would seem necessary should be provided for use in case of accident or necessity of repair of trunk sewer. Unless we hear from you to the contrary, we shall proceed to construct the main trunk sewer and approve local connections therewith, making and requiring such provision for such overflows similar to those provided and required in the Charles River and north metropolitan systems, to be used only in case of emergency.

For the Board,

Very respectfully yours,

(Signed)

EDWARD P. FISK,
Clerk.

The reply of the State Board of Health follows : —

OFFICE OF STATE BOARD OF HEALTH,
STATE HOUSE, BOSTON, March 26, 1896.

To the Metropolitan Sewerage Commissioners, Boston, Mass.

GENTLEMEN : — The State Board of Health received from you, on March 18, a communication with reference to the use of sewage overflows in connection with the proposed Neponset valley sewerage system, in which you state that unless you hear from the Board to the contrary you shall proceed to construct the main trunk sewer and approve local connections therewith, making and requiring such provisions for such overflows similar to those provided and required in the Charles River valley and north metropolitan systems, to be used only in case of emergency.

The plan presented by you for an intercepting sewer for Nepon-

set River and Mother Brook basins, including a portion of the Charles River basin, which this Board approved in its communication dated Feb. 18, 1896, did not contain any provision for sewage overflows, and no mention of sewage overflows was made in the report of your engineer submitted with the application.

Before the Board can approve a plan providing for sewage overflows it will be necessary that you submit a plan showing the location of the proposed overflows, with a description of the proposed method of constructing and operating them.

By order of the Board,

(Signed)

SAML. W. ABBOTT,

Secretary.

On April 18 the Board authorized the clerk to send the following in reply :—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, April 18, 1896.

The State Board of Health, Boston, Mass.

GENTLEMEN :—In response to your communication of March 26, 1896, stating that a plan will be required showing the proposed overflows from the Neponset valley intercepting sewer, with a description of method of construction and operation, the Board desires to state as follows: the Charles River system has been operated since 1892 as a branch of the Boston main drainage. During rainy weather, and when the pumps are not in operation, the trunk sewer of the Boston system has been surcharged, flooding the Charles River branch and requiring the construction and maintenance of automatic overflows for the efficient and safe operation of the system. The Board has deemed it expedient to require, for safety and convenience in maintaining and repairing the sewer, and as a further safeguard against flooding from Boston's system, that cities and towns tributary to the Charles River system should also construct and maintain automatic overflows at all their connections from areas of considerable size.

The Neponset valley interceptor, like the Charles River main, will, when completed, be operated as a branch of the Boston system, and it is anticipated that it also will be subject, at its lower end, to flooding during the surcharged condition of the Boston trunk sewer. The Board is of the opinion that the safe operation of the Neponset branch will require the following overflows from the main sewer :—

First. — At Granite bridge, Dorchester, an automatic overflow into the tidal currents of Neponset River, having a carrying capacity equal to the main sewer at that point.

Second. — Near Mill Lane, Dedham, an overflow into Mother Brook, having a carrying capacity equal to the main sewer at that point, controlled by a Penstock valve, to be operated by hand and only when the main sewer is surcharged at that point.

Plans of the proposed overflows are submitted, as requested.

For convenience and safety in maintenance, to provide against possible accident or injury to the main sewer, or flooding at low levels from Boston main sewer, the Board is of the opinion that, as in the Charles River branch, automatic safety overflows should be provided from all local connections receiving drainage from ten acres or more; such overflows above East Street, Dedham, to be permanently sealed off, and never used so long as the Charles River and its shores are used as a source of domestic water supply.

At the date of the engineer's preliminary report on the Neponset valley sewer, the Board had not decided to acquire the Dorchester interceptor from Central Avenue to Granite bridge, and were not prepared and did not at that date ask advice in the matter of overflows from the main sewer. With the exception of Milton, no city or town of the valley above Central Avenue had then prepared any studied scheme for its local connections, and the Board was equally unprepared to ask advice at that date in the matter of overflows from local connections. The engineer to the Board, after conference with the engineers for the tributary cities and towns, has prepared a study for a system of branches for local connections, which are shown on the accompanying map, subject to such minor modifications of size, location, etc., as may necessarily be developed during the more detailed surveys for the construction of local sewers. The Board desires to approve and adopt automatic relief overflows at all the connections shown, with the understanding that such as are above East Street, Dedham, shall not be opened for use so long as the Charles River is used as a source of water supply for Brookline, Newton and other cities. A characteristic study for one of these connections is submitted, and your advice and approval is asked in the matter of overflows from the main sewer and from local connections as outlined above.

Respectfully submitted,

For the Board,

(Signed)

EDWARD P. FISK,
Clerk.

To this the following was received : —

OFFICE OF STATE BOARD OF HEALTH,
STATE HOUSE, BOSTON, May 7, 1896.

To the Metropolitan Sewerage Commissioners.

GENTLEMEN : — The State Board of Health received from you, on April 18, an application for approval of proposed sewage overflows in connection with the proposed Neponset valley intercepting sewer, accompanied by plans showing the location of proposed overflows from the main sewer and tributary systems and designs for these overflows. Two of these overflows are proposed for the discharge of sewage from the main intercepting sewer, and it is understood that the others are automatic overflows to be connected with the tributary systems near their junction with the main sewer, by which sewage from the tributary sewers may be discharged into local water courses when the sewage in the intercepting sewer rises to a certain height. One of the proposed overflows presented by you is located upon the main sewer at Granite Bridge, but, since this is below the portion of the sewer to which the reply of the Board, dated Feb. 18, 1896, was limited, at your request, the Board has omitted consideration of this overflow.

It is stated in the application that your Board “desires to approve and adopt automatic relief overflows at all connections shown, with the understanding that such as are above East Street, Dedham, shall not be opened for use so long as the Charles River is used as a source of water supply for Brookline, Newton and other cities.” As the discharge of sewage into the Charles River in this vicinity is, under present conditions, prohibited by law, this Board cannot approve any overflows upon this portion of the sewer at the present time. The overflows under consideration, therefore, are those included on the main sewer and tributary systems between the point where the sewer crosses East Street in Dedham and its junction with the Dorchester intercepting sewer at Central Avenue, Dorchester.

By the existing conditions, sewage from all overflows in this district would naturally be discharged either into Mother Brook or the Neponset River, or tributaries of these streams. There are several dams along Mother Brook and the Neponset River, forming mill ponds in some cases of considerable size, and all of the proposed overflows would be above one or more of these dams. There is a large and rapidly growing population in the vicinity of these streams and their tributaries, and, in the opinion of the Board, it is desirable that these streams be kept free from pollu-

tion, and that the discharge of sewage into them be prevented, if possible.

Regarding the danger of the proposed main sewer and tributary systems becoming surcharged by sewage by backing up from the Boston system, the Board is informed that by existing provisions the Dorchester intercepting sewer is automatically disconnected from the Boston main drainage sewer at times when the latter is surcharged, and provision is made whereby the Dorchester intercepting sewer may at such times discharge into tide-water; moreover, according to the plan approved by this Board in a communication to your Board, dated Feb. 18, 1896, the bottom of the Neponset valley sewer at its lower end in Central Avenue, Dorchester, is at about grade twenty, or several feet above high water. It does not seem to this Board that there is danger that the Neponset valley sewer may be surcharged from this cause.

Regarding the necessity of automatic overflows for safety and convenience in maintaining and operating a separate system of sewers, much information is furnished by experience in the operation of such systems already in use in this State. A number of such systems have been in successful operation, in some cases for several years, without automatic overflows, and information regarding these systems indicates that the necessity for such overflows has not arisen.

In view of all the circumstances, the Board declines to modify its approval under date of Feb. 18, 1896, of a system of sewage disposal for Neponset River valley which had been submitted by you, by adopting, as a part of that plan, the plan of automatic relief overflows proposed in your communication of April 18, 1896.

It is possible that there are points in the system not known to this Board where unusual emergencies may occur, and where safety would require an outlet gate which can be opened temporarily; if such points are found to exist this Board will consider plans you may present in regard to them, but this Board is desirous to avoid discharging sewage above any of the mill-dams on Neponset River when not absolutely necessary.

By order of the Board,

(Signed)

SAML. W. ABBOTT,

Secretary.

At its meeting on May 2, 1896, this Board passed the following : —

Voted, That, for the purpose of constructing, maintaining and operating the Neponset valley system of sewerage, it is neces-

sary to take Sections 9, 10 and 11 of the Dorchester intercepting sewer, extending from Granite Avenue, along the Neponset River to Central Avenue, in Dorchester, and that plans of said sections are approved and adopted, and that a communication to the State Board of Health be made transmitting said plans for their approval; and that said communication be signed by the chairman.

In accordance with the above the following was sent:—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 1 MT. VERNON STREET,
BOSTON, May 2, 1896.

To the State Board of Health, Boston, Mass.

GENTLEMEN:—This Board has this day determined that for the purpose of constructing, maintaining and operating a system of sewage disposal for the city of Boston and the towns of Dedham, Hyde Park and Milton, under the provisions of chapter 406 of the Acts of the year 1895, it is necessary to take that part of the Dorchester intercepting sewer of the Boston main drainage system which extends from Granite Avenue in Dorchester, alongside of the Neponset River to Central Avenue in Dorchester, as indicated on three plans herewith submitted of even date, marked Metropolitan Sewerage Commission, Neponset valley system, Sections 9, 10 and 11, and has this day approved and adopted said plans as a part of said system of sewage disposal supplementary to the plans already approved and adopted by this Board and approved by you.

We therefore transmit this report and these plans to you for your approval.

Very respectfully yours,
(Signed)

HOSEA KINGMAN,
Chairman.

To the above the following reply was received:—

OFFICE OF STATE BOARD OF HEALTH,
STATE HOUSE, BOSTON, June 6, 1896.

To the Metropolitan Sewerage Commissioners.

GENTLEMEN:—The State Board of Health has considered the application submitted by you on May 4, 1896, in which you request the approval by this Board of the taking by the Metropolitan Sewerage Commissioners of the portion of the Dorchester intercepting sewer between Central Avenue and Granite Avenue, in Dorchester, as a portion of the proposed Neponset valley sewerage

system, provided for by chapter 406 of the Acts of the year 1895, and having carefully considered the plans, hereby approves them as a part of the system of sewage disposal for the Neponset valley, supplementary to the plans already approved by this Board.

By order of the Board,

(Signed)

SAML. W. ABBOTT,
Secretary.

CONTRACTS.

At its meeting on Oct. 4, 1895, the Board directed the engineer to prepare contract plans for this system, and on Feb. 29, 1896, directed that Sections 13, 14, 15 and 16 be advertised, bids upon the two former to be received until noon of Saturday, March 21, and those of the two latter until noon of Saturday, March 28, 1896. The bids on these sections were accordingly received and opened as advertised, and Table B in the Appendix contains a full list of the bids on each section, together with a statement in each case of the one accepted. The methods formerly adopted and used for receiving and opening bids have been fully described in previous reports, and were followed in each instance in this case, the contract being awarded on each of these sections, and on nearly every section of this system, to the lowest bidder. Harry P. Nawn was awarded, and duly executed, the contracts, furnishing sureties on the bonds, as required by the Board. The Board at its meeting on March 28, 1896, directed that Sections 17, 18, 19 and 20 be advertised, bids upon the two former to be received until noon of April 18, those upon the two latter until noon of April 25, 1896. These sections were accordingly advertised as directed, and on April 25 the Board accepted the bid of Geo. R. Newman & Co. of Providence, R. I., the lowest bidder on Section 17, for the construction of said section, and at the request of Wm. T. Ross of Waltham, the lowest bidder on Section 18, granted permission for the withdrawal of his bid, and accepted the bid of the Troy Public Works Company of Troy, New York, the next lowest bidder, for constructing said section. The successful bidders on these sections furnished bonds and sureties acceptable to the Board. The Board on the same date (April 25) received bids for constructing Sections 19 and 20, which on May 2,

1896, were in each case awarded to Geo. S. Good & Co. of Lock Haven, Pa., the lowest bidders, who duly executed contracts and furnished bonds for the same on both sections. At its meeting on May 16, 1896, the Board voted that the sections (21 to 25 inclusive) be advertised, bids for the first two (21 and 22) to be opened June 13 and the remainder (23 to 25) June 20, 1896. On June 13 bids were received on Sections 21 and 22, and upon June 27 the Board accepted the bid of Ezra A. Mathers of Washington, D. C., for constructing said sections, he duly executing contracts and furnishing sureties acceptable to the Board. The Board at this date (June 27) received bids for three sections (23, 24 and 25) of this system, postponing action thereon until certain facts regarding some of the bidders could be ascertained. At its meeting on July 1, 1896, the bid of Haskins & Murphy, the lowest bidders on Section 23, was accepted, as was also their bid upon Section 24; while on Section 25 the Board accepted the bid of Edw. W. Everson, all of said parties duly executing their contracts and giving bonds acceptable to the Board. Your attention is called to tables B and C of the Appendix, where a statement may be found of all bids received, together with the date of said reception and the award made in each case.

LAND TAKINGS.

The land takings of the Board during the past year have all been upon this system. On March 28, 1896, the Board executed deeds, taking the right to construct, operate and maintain an underground sewer, partly in Boston and partly in Hyde Park, covering Sections 13, 14, 15, 16 and 17 in part, which deeds and plans have been recorded; that in Boston in Suffolk Registry, book 2347, page 385; that in Hyde Park in Norfolk Registry, book 757, page 214. These takings comprise the right of way necessary for the construction of the sewer from the point in Central Avenue in Dorchester, where the three sections constructed by the city of Boston, previously referred to, terminate, to and including River Street in Hyde Park, in the vicinity of the Mattapan Mills.

On April 25, 1896, the Board executed a deed (recorded in Norfolk Registry, book 759, page 601) taking "rights, privileges and easements" in land in Hyde Park, as shown on two plans. This taking includes the line of the sewer from the point in River Street (east) where the preceding taking terminated to a point in River Street (west) in the vicinity of Atherton Street.

On June 13, 1896, the Board executed a deed (recorded in Norfolk Registry, book 764, page 5) taking the right of way in Hyde Park and a part of Dedham, comprising the territory on the line of the sewer, from the terminus of the former taking in River Street in the neighborhood of Atherton Street to the property of the Merchants' Wool-len Company at Emmett Avenue and Colburn Street in Dedham.

The only other taking on this line made during the year is dated July 1, 1896, and recorded with Norfolk Deeds, book 764, page 501. This taking includes the right to construct, operate and maintain the sewer in land from the terminus last mentioned to a point in the line dividing land of J. H. Nay from land of Elijah Bonnemort, about three hundred and fifty feet beyond the point where the sewer crosses the Dedham branch of the New York, New Haven & Hartford Railroad.

LOCATION OF SEWER LINE.

The centre line of the sewer on these sections may be described as follows: beginning at a point on Central Avenue in Dorchester, where the sections constructed by the city of Boston terminate, the line passes through said avenue and is deflected to the west, through land of the Tileston & Hollingsworth Company, and crosses under the mill pond of said company to the vicinity of the ice house; from here it crosses various private estates, on the line of a proposed street, to River Street, and follows the line of said street to Fremont Street. Opposite said Fremont Street it passes through various private estates along the line of the river and the New York, New Haven & Hartford Railroad to Mattapan Square, which it crosses, and continues along River Street, crossing the boundary line between Boston and

Hyde Park and continuing in said River Street to a proposed street leading to the river, on land now or late of the Sally R. Sumner estate. Following this proposed street to the river and deflecting to the south-west, it follows the bank of the river through various private estates to West Street, which it crosses, and continues through private estates and land of the New England Railroad Company to Station Street in the neighborhood of Hyde Park station, through which street it passes and crosses the railroad from said street to Walnut Street; passing through said Walnut Street and Walnut Place to land of Blaikie's Woollen Mill, which land it crosses to Hyde Park Avenue, and is continued in said avenue and Factory Street to the Providence division of the New York, New Haven & Hartford Railroad. Here the railroad is crossed to Barry Place, and the sewer is continued in said place to Business Street, which street is followed to River Street. The sewer is continued in said River Street to the south-westerly line of Atherton Street, where it passes through private estates along Mother Brook (crossing the boundary line between Hyde Park and Dedham) to the junction of Mill and Lewis lanes with Emmett Avenue. Crossing said Mill Lane, it continues through private estates to Colburn Street, which street it follows to Maverick Street, and continues in said Maverick Street for about two hundred feet, where it deflects to the north-west and follows through private land, along Mother Brook to Curve Street, in which it continues across East Street; and after following East Street for about one hundred and fifty feet, deflects to the north-west, crossing private estates, to the end of the section, about three hundred and fifty feet beyond the crossing of the Dedham branch of the New York, New Haven & Hartford Railroad.

The total length of this line is 35,656 feet, of which 20,241 feet lie in private land and 15,415 feet in public highways.

There have been no settlements for land taken upon this system. The Board has caused, however, three disinterested parties to view the estates affected by said takings, and they have reported in writing to the Board the damage sustained in each particular case, which report is on file in this office.

Some of the parties owning the estates thus affected have agreed to accept the award so made, and later the amount agreed upon will be paid them upon their giving the Commonwealth satisfactory releases.

On July 21, 1896, S. B. Balkam & Co., for good and sufficient consideration, signed an agreement to execute a release on or before July 1, 1897, for land embraced within a taking made March 28, 1896, providing certain things in said agreement were performed by this Board meantime.

EXPENDITURES.

The expenditures upon this system for the year have been \$200,604.35. This, with the amount previously reported, \$2,649.95, makes \$203,254.30 expended to date, particulars of which will be found in the Appendix.

In the letter of the chairman of this Board, under date of Jan. 28, 1896, to the committee on metropolitan affairs (already quoted), attention is called to the fact that by chapter 406, Acts of 1895, but \$500,000 is appropriated, while the studies and plans indicate that considerably more will be required for the completion of the work authorized. After speaking of this, he says: "We call attention to this, not that we think it will be necessary to make any additional appropriation for this purpose this year, as the present appropriation will probably be sufficient for all the work we can accomplish in this direction this year, but that you may have a full understanding of the situation."

Accordingly, this Board would recommend, and ask, that an additional sum of \$300,000 be provided for the completion of this system.

GENERAL—ALL SYSTEMS.

COMMISSION TO APPORTION COSTS AND EXPENSES.

In the last annual report, after stating that on Feb. 5, 1895, the court appointed William C. Endicott of Salem, with John E. Sanford and Edmund H. Bennett, both of Taunton, commissioners, under section 14 of chapter 439 of the Acts of 1889, we say:—

Here the matter has rested to this time (Oct. 1, 1895); but the Hon. Wm. C. Endicott, one of the commissioners appointed, having declined said appointment, the court will be asked at an early date to appoint a successor.

The supreme judicial court of Suffolk County, sitting in equity in answer to a petition filed in said court Oct. 4, 1895, did on October 9 of said year appoint Everett C. Bumpus of Quincy, county of Norfolk, to be commissioner in place of William C. Endicott of Salem, declined; and in answer to a petition of this Board, filed in said court Oct. 14, 1895, praying for the appointment of three commissioners to apportion the expenses upon the Neponset River valley system, under chapter 406, Acts of 1895, issued a decree on December 16 of the same year appointing the same three commissioners, viz., Edmund H. Bennett and John E. Sanford of Taunton and Everett C. Bumpus of Quincy, for said purpose.

Said commission has not at this date made its report; but we are permitted to print the following from advanced sheets, furnished us by said commission, substantially in the same form that will be presented to the court later, which is self-explanatory: —

COMMONWEALTH OF MASSACHUSETTS.

SUPREME JUDICIAL COURT. SUFFOLK, ss.

IN EQUITY, No. 4728.

HOSEA KINGMAN and others, METROPOLITAN SEWERAGE COMMISSIONERS, Petitioners. *In re* The North Metropolitan and the Charles River Sewerage Systems. St. 1889, c. 439; St. 1894, c. 307; St. 1895, c. 294; St. 1896, c. 414.

SUFFOLK, ss.

IN EQUITY, No. 5056.

THE SAME, Petitioners. *In re* The Neponset River Sewerage System. St. 1895, c. 406.

REPORT AND AWARD.

These are petitions for the appointment of apportionment commissioners under the several special laws of this Commonwealth, known as the metropolitan sewerage acts.

NORTH METROPOLITAN AND CHARLES RIVER SYSTEMS.

The original act, St. 1889, c. 439, authorized the construction, maintenance and operation by the Commonwealth of two systems

of public sewers, extending through the Mystic River valley and the Charles River valley to tide-water. The construction of these systems has been practically completed; so that now, as stated in the last annual report of the Metropolitan Sewerage Commissioners, both systems "are in operation and receiving sewage from the cities and towns for whose relief they were built."

The Mystic River main sewer commences in the town of Stoneham, runs by a circuitous course, with various lateral branches, in a general south-easterly direction, and discharges into the sea at Deer Island. This system, known as the north metropolitan system, originally embraced the following cities and towns, as alphabetically arranged: Arlington, Belmont, Boston (East Boston and Charlestown districts), Cambridge, Chelsea, Everett, Malden, Medford, Melrose, Somerville, Stoneham, Winchester, Winthrop and Woburn. To these was added, by St. 1896, c. 414, a small area at the southerly extremity of the town of Wakefield, comprising the villages of Greenwood and Boyntonville.

The Charles River sewer begins at the lower line of Waltham, extends along the southerly bank of Charles River to the intersection of Gainsborough (formerly Camden) Street with Huntington Avenue, in the city of Boston, and thence discharges through the Boston main sewer into tide-water at Moon Island. This system includes the main area of the city of Boston, with Brookline, Newton, Waltham and Watertown. It has no physical connection with the north metropolitan system.

To provide for the cost of constructing these two systems, the original act authorized an issue by the Commonwealth of its scrip or certificates of debt, to be designated on the face thereof as the metropolitan sewerage loan, for a term not exceeding forty years, and to an amount not to exceed \$5,000,000. By supplementary acts, additional issues have been authorized as follows: by St. 1894, c. 307, \$500,000; by St. 1895, c. 294, \$300,000; and by St. 1896, c. 414, \$30,000,—making a total authorized loan of \$5,830,000 for the two systems.

Although these additional issues were intended exclusively for the completion or enlargement of the north metropolitan system, each of the supplementary acts expressly provides that "Any scrip or certificates of debt issued under the provisions of this act shall be considered as an addition to, and shall become a part of, the loan authorized by [the original act] chapter 439 of the Acts of the year 1889;" and that "the sinking fund established under the provisions of said chapter shall be a sinking fund for the extinguishment of the debt authorized by this act;" with an added provision for a corresponding enlargement of the sinking fund.

While, however, but one loan and one sinking fund have been thus provided for the construction of both of these systems, the cost of the construction of each system, as well as the current expense of its maintenance and operation, is carefully discriminated in the accounts kept by the proper officers of the Commonwealth; so that, as hereinafter shown, an apportionment can (and should) be so made that the cities and towns in the respective systems shall pay only such portion of the total cost of both systems as is strictly chargeable to the particular system to which they belong.

The total authorized loan of \$5,830,000, issued (or to be issued) as above, bears interest at the rate of three per cent. per annum, and matures Jan. 1, 1930.

NEPONSET RIVER SYSTEM.

By St. 1895, c. 406, a third system was established to dispose of the sewage of the Neponset River valley. The main sewer of this system, now under construction, will begin at Worley Street in the West Roxbury district of the city of Boston, and, with provision for branches to Brookline and Newton, will run in a southerly and easterly course, along the northerly side of Mother Brook and Neponset River, to Central Avenue at Dorchester Lower Mills. It here connects with the end of the Dorchester intercepting sewer and discharges through that sewer, and thence through the main sewer of the city of Boston, like the Charles River system, into tide-water at Moon Island. The territory tributary to this system includes considerable areas in the West Roxbury and Dorchester districts of Boston, with the towns of Dedham, Hyde Park and Milton.

For the construction of this system the act provides for a State loan of \$500,000, on terms and conditions precisely similar to those in the case of the loan for the north metropolitan and Charles River systems. The two loans, however, although designated in the respective acts by the same title, are wholly distinct loans, as are also the sinking funds provided for their redemption; and all accounts pertaining to the two will be so kept. The apportionment of cost and expense for the Neponset River system is therefore to be made in entire independence of that for both or either of the other two systems.

The loan for the Neponset River system also bears interest at the rate of three per cent. per annum, but will mature March 1, 1935.

APPORTIONMENT OF COST OF CONSTRUCTION, MAINTENANCE AND OPERATION.

All of the sewerage acts provide in the same terms that the expenditure incurred by the Commonwealth in the construction of the several systems shall be repaid by the cities and towns included therein, in annual payments sufficient to meet the accruing interest on the respective sewerage loans, and sufficient also to create sinking funds which, with their accumulations, will extinguish the loans at their maturity. The cities and towns in each system are required in like manner to reimburse to the Commonwealth the annual cost of maintenance and operation.

The several acts further provide for the appointment by the supreme judicial court of three commissioners, whose duty it shall be *to determine the proportions* in which the several cities and towns in each system shall annually, for the term of five years next following the year of the first issue of sewerage scrip or certificates of debt as aforesaid, pay money into the treasury of the Commonwealth ; *first*, to meet the *interest and sinking fund requirements* for each of said years, as estimated by the treasurer ; and *second*, to meet the *cost of maintenance and operation* for each of said years, as estimated by the Board of Metropolitan Sewerage Commissioners and certified to the treasurer. Commissioners are to be appointed in like manner to make a similar apportionment for each succeeding term of five years.

In May, 1891, Ebenezer R. Hoar, William C. Endicott and John E. Sanford were accordingly appointed the commissioners to make such apportionment for the north metropolitan and Charles River systems for the first term of five years, 1891 to 1895, both inclusive ; and their award, made in November, 1891, was duly accepted by the court, and has been fully complied with by the several cities and towns in those systems.

On Oct. 9, 1895, the undersigned, Edmund H. Bennett, John E. Sanford and Everett C. Bumpus, by an order of the supreme judicial court, under the first of the above petitions, were appointed the commissioners to make such apportionment for the north metropolitan and Charles River systems for the *second* term of five years ; and on Dec. 16, 1895, by a like order under the second petition, they were appointed to make such apportionment for the Neponset River system for the *first* term of five years ; the term in both cases covering the same period of years, namely, 1896 to 1900, both inclusive.

Although, as before stated, the financial relations of the three systems to the Commonwealth and to each other are such that they

must, for the purposes of the apportionment, be treated as distinct systems, they are nevertheless essentially alike in their legal constitution and character, and in the scope and purpose of their creation. We have therefore seen no reason why the same general principles and rules or methods of apportionment should not apply to the several systems alike, or why, as regards our present duty, they should not all be dealt with in one and the same report.

After receiving notice of our appointments as above, we accordingly assigned a time and place for hearing all of the parties interested in the matters submitted to our determination, and gave due notice thereof to the cities and towns named in the several sewerage acts, as well as to the Board of Metropolitan Sewerage Commissioners; and all of said cities and towns appeared by their proper officers, solicitors or counsel, at the time and place appointed for such hearing, or at the adjournments thereof, with such witnesses, evidence and arguments as they saw fit to produce or offer; and they have been publicly heard by all of us sitting together as fully as they or any of them desired. Said hearings were held, with the acquiescence of all parties, either at the State House, or at the Court House in Pemberton Square, Boston, on Feb. 8, March 6 and 20, April 24, May 1, 8 and 22, and June 3, 26 and 27, 1896. The Metropolitan Sewerage Commissioners and their engineer and clerk have also appeared before us or met with us from time to time, and have given such information as was requested of them, both at the public hearings and at our meetings for conference and for the further investigation of the facts involved in our decision.

BASIS OF APPORTIONMENT.

The question that first presents itself, and the question of radical importance in the case, is *the basis* on which the apportionment should be made. The several acts prescribe no definite standard or rule. They all provide, in the same broad terms, that the commissioners appointed for the purpose shall make the apportionment "*in such a manner as they shall deem just and equitable*;" and this is the definition of our duty as laid down by the court in the orders of our appointment.

It should, perhaps, be noted that the act creating the Neponset River system (St. 1895, c. 406, § 16) contains this additional clause: "In making their award, the commissioners may take into consideration the amount of the use of the sewers by said city or towns respectively; the population and valuation thereof; and also the extent, if any, to which said main sewers relieve the city or towns respectively of the necessity of constructing local sewers at

their own charge; and any other considerations as may seem to them just and equitable." We construe this language, however, as permissive or suggestive, rather than as directory; and we do not understand that it adds anything to the powers or duties implied in the more brief and comprehensive formula first above quoted.

At the hearings before us, various bases or methods of apportionment were urged or suggested, in behalf of a few of the municipalities concerned, as desirable or possible to be adopted, or as at least proper to be taken into equitable consideration; such, for example, as an apportionment of the whole cost of construction and expense of maintenance and operation according to the assessed value of real and personal estate, or according to the assessed value of real estate alone, without regard in either case to population; or according to population alone, without any regard to taxable valuation; or according to the total areas, the assessed areas, the drainable areas, or the areas actually sewered, in the several cities and towns; or by taking into account the length of public sewer lying within the city or town limits, and the number of connections, present and prospective, of the local sewers therewith; or the location of the public sewer, as running through the middle or on the outskirts of the city or town, and the consequent expense of extending the local sewers to connect with it; or the amount of storm or surface water admitted into the local sewers and thereby discharged into and through the public sewer; or the nature of the subsoil, and the amount of underground percolation, direct and indirect, into the public sewer; or the fact that the city or town had already established an efficient sewerage system of its own; or the probable rapidity of municipal growth in population and wealth during the period to be covered by the apportionment.

This enumeration might be extended; but it is already long enough to indicate how difficult a problem it might be to combine, in their just proportions, elements and factors so complex and diverse, and of such unknown or conjectural value, so as to arrive at a formulated and intelligible result. However diligently and conscientiously we might labor to work out such an apportionment, we apprehend that we should not in the end be able to assure ourselves beyond a reasonable doubt that it was "just and equitable," and much less to convince the great majority of those concerned that it was not fanciful and arbitrary.

VALUATION AND POPULATION.

So far as may be consistent with substantial justice, it is desirable that the bases and methods adopted should be simple, definite, easily understood and of familiar application. Under our laws, no facts are more carefully ascertained than the taxable value of real and personal property, and the resident population, in the several cities and towns. When ascertained, these facts become matters of public record, about which there can be no dispute; and they are the usual and approved factors in the adjustment of public rights and the apportionment of public burdens.

The sewerage systems in question were established "to promote the public health, to avert disease and to prevent nuisances." (153 Mass. 571.) We have been unable to find, upon the whole, any better measure of the ability and duty to contribute to the cost of public works of this character than the taxable valuation of the several cities and towns which compose the districts for whose common welfare these systems were created, or any better measure of the use enjoyed and the benefits received by the several municipalities than the number of persons who dwell within their respective limits.

We have accordingly determined to apportion the payments required to meet the *interest and sinking fund requirements* of the sewerage loans, which represent the *cost of construction*, upon the basis of *valuation*; and the payments required to meet the *annual cost of maintenance and operation*, upon the basis of *population*. For the former purpose we have used the property valuations which are established by St. 1895, c. 90, as the basis for the apportionment to cities and towns of State and county taxes; and for the latter purpose, the State census of 1895.

We have found in a few of the municipalities areas of larger or smaller extent which lie in other watersheds, and which it is physically impracticable to drain into the systems in question. Proper deductions have been made for the valuation and population of such areas. Portions of the city of Boston are tributary to each of the three systems. The valuation and population of the area tributary to each system are included in the apportionments for that system alone. In the case of the town of Wakefield, the valuation and population of only that section which was annexed to the north metropolitan district by St. 1896, c. 414, have been taken into account, due consideration being given also to the fact that this section had contributed nothing to the cost of construction during the first term of five years.

APPORTIONMENT FOR THE NORTH METROPOLITAN AND CHARLES RIVER SYSTEMS.

1. *Interest and Sinking Fund Requirements.*—As has been stated on page lxiii, there is but one loan provided for the construction of these two systems. This loan represents the cost of both systems. It is clear that each system should contribute to the interest and sinking fund requirements of this loan in proportion to its own particular cost. It is necessary, therefore, to ascertain, as the first step, the actual and relative cost of each system as a whole.

The cost of the north metropolitan system, up to March 1, 1896, was \$4,876,831.24. Considerable work remains to be done in the finishing of this system, and there are numerous unsettled contracts and claims, including suits for land damages. This system is also to be extended to Wakefield. Altogether, it is estimated that its total cost will be (approximately) \$5,030,000.

The cost of the Charles River system, up to the same date, was \$787,895.26. It is estimated that outstanding claims, comparatively few and small, will bring its total cost up to (in round numbers) \$800,000.

The total cost of both systems ($\$5,030,000 + \$800,000$) will therefore be \$5,830,000, which is the exact amount of the loan. Now, \$5,030,000 is 86.28 per cent. and \$800,000 is 13.72 per cent. of \$5,830,000. It follows that 86.28 per cent. of the total cost of both systems is chargeable to the north metropolitan system and 13.72 per cent. to the Charles River system. It is equally clear that 86.28 per cent. of the interest and sinking fund requirements of the total loan should be apportioned to the cities and towns in the north metropolitan system, and that 13.72 per cent. should be apportioned to those in the Charles River system.

Having thus fixed the proportions of the two systems as a whole, it is next necessary to determine, upon the basis of valuation as hereinbefore explained, the proportions of the several cities and towns in each system. The arithmetical process requires no elucidation. Having obtained the latter proportions, it will be evident that the cities and towns in the north metropolitan system should pay their respective proportions or percentages (as thus obtained) of the 86.28 per cent. which has been found chargeable to that system; and that the cities and towns in the Charles River system should pay their respective proportions or percentages (as thus obtained) of the 13.72 per cent. found chargeable to the latter system. By reducing or combining the percentage of each city or town with that of the system to which it belongs, we obtain the

desired proportions or percentages in which the several cities and towns in both systems should contribute to the interest and sinking fund requirements of the whole loan. The results are tabulated below.

We therefore *determine and award* that the several cities and towns in the north metropolitan and Charles River systems shall annually pay money into the treasury of the Commonwealth, for the term of five years, 1896 to 1900, both inclusive, to meet the interest and sinking fund requirements for each of said years, as estimated by said treasurer, of the metropolitan sewerage loan, authorized and issued for the construction of said systems, and any deficiency in the amount previously paid in, as found by said treasurer, in the proportions shown in the right-hand column of the following table : —

Table showing the Proportions in which the Several Cities and Towns in the North Metropolitan and Charles River Systems shall pay Money to meet Interest and Sinking Fund Requirements under Sts. 1889, c. 439 ; 1894, c. 307 ; 1895, c. 294 ; and 1896, c. 414.

CITY OR TOWN.	System.	Percentages.	Proportions.
			Per Cent.
Arlington,	North metropolitan,	2.74 of 86.28	2.86
Belmont,	North metropolitan,	1.30 of 86.28	1.12
Boston,*	North metropolitan,	18.96 of 86.28	20.08
Boston,†	Charles River,	27.08 of 13.72	
Brookline,	Charles River,	83.13 of 13.72	4.55
Cambridge,	North metropolitan,	26.19 of 86.28	22.60
Chelsea,	North metropolitan,	7.87 of 86.28	6.36
Everett,	North metropolitan,	4.01 of 86.28	3.46
Malden,	North metropolitan,	8.19 of 86.28	7.07
Medford,	North metropolitan,	5.29 of 86.28	4.56
Melrose,	North metropolitan,	3.22 of 86.28	2.78
Newton,	Charles River,	25.82 of 13.72	3.47
Somerville,	North metropolitan,	14.83 of 86.28	12.86
Stoneham,	North metropolitan,	1.28 of 86.28	1.10
Wakefield,‡	North metropolitan, . . . .	.28 of 86.28	.24
Waltham,	Charles River,	10.02 of 13.72	1.37
Watertown,	Charles River,	4.45 of 13.72	.61
Winchester,	North metropolitan,	2.20 of 86.28	1.90
Winthrop,	North metropolitan,	1.49 of 86.28	1.20
Woburn,	North metropolitan,	3.15 of 86.28	2.72
Total, . . . .	. . . . .	. . . . .	100.00

* East Boston and Charlestown districts.
† Brighton and portions of Back Bay and Roxbury districts.
‡ Villages of Greenwood and Boyntonville.

2. *Cost of Maintenance and Operation.* — Separate accounts are kept, as before stated, of the current annual expense incurred by the Commonwealth in maintaining and operating the north metropolitan and Charles River systems, respectively ; and there is consequently no occasion for the apportionment of this expense as between the two systems.

The proportions in which the cities and towns in each system shall annually pay money to meet the cost of the maintenance and operation of their own system have been computed upon the basis of population, in accordance with the principles and methods hereinbefore indicated, and with the results shown below.

We *determine and award* that the several cities and towns in the north metropolitan and Charles River systems, respectively, shall annually pay money into the treasury of the Commonwealth, for the term of five years, 1896 to 1900, both inclusive, to meet the cost of the maintenance and operation of said systems for each of said years, as estimated by the Board of Metropolitan Sewerage Commissioners and certified to said treasurer, and any deficiency in the amount previously paid in, as found by said treasurer, in the proportions set down in the following table : —

Table showing the Proportions in which the Cities and Towns in the North Metropolitan and Charles River Systems shall pay Money to meet the Cost of Maintenance and Operation of said Systems, respectively, under Sts. 1889, c. 439 ; 1894, c. 307 ; 1895, c. 294 ; and 1896, c. 414.

NORTH METROPOLITAN SYSTEM.		CHARLES RIVER SYSTEM.	
CITY OR TOWN.	Proportions.	CITY OR TOWN.	Proportions.
	Per Cent.		Per Cent.
Arlington,	1.79	Boston,*	25.41
Belmont, . . . . .	.78	Brookline,	16.24
Boston,†	22.82	Newton,	28.00
Cambridge,	22.47	Waltham,	21.38
Chelsea,	8.61	Watertown,	7.97
Everett,	5.11		
Malden,	8.18		
Medford,	3.98		
Melrose,	3.24		
Somerville,	14.37		
Stoneham,	1.73		
Wakefield,‡ . . . . .	.18		
Winchester,	1.69		
Winthrop,	1.15		
Woburn,	3.90		
Total,	100.00	Total,	100.00

* Brighton and portions of Back Bay and Roxbury districts.
† East Boston and Charlestown districts.
‡ Villages of Greenwood and Boyntonville.

APPORTIONMENT FOR THE NEPONSET RIVER SYSTEM.

This system, though physically related to the Charles River system so far as to have a similar outlet of discharge through the improved sewerage system of the city of Boston, stands alone as regards the provision made for its construction, maintenance and operation.

It is sufficient to say that the apportionment for *interest and sinking fund requirements* has been made on the basis of *valuation*, and that for *cost of maintenance and operation* on the basis of *population*, in accordance with the same general rules and methods as have been applied to the other systems.

We *determine and award* that the several cities and towns in the Neponset River system shall annually pay money into the treasury of the Commonwealth, for the term of five years, 1896 to 1900, both inclusive, to meet the interest and sinking fund requirements for each of said years, as estimated by said treasurer, of the loan authorized and issued for the construction of said system, and also to meet the cost of the operation and maintenance of said system for each of said years, as estimated by the Board of Metropolitan Sewerage Commissioners and certified to said treasurer, and any deficiency in the amount previously paid in, as found by said treasurer, in the proportions set down in the following table : —

Table showing the Proportions in which the Several Cities and Towns in the Neponset River System shall pay Money to meet Interest and Sinking Fund Requirements, and to meet Cost of Maintenance and Operation, respectively, under St. 1895, c. 406.

CITY OR TOWN.	PROPORTIONS TO MEET	
	Interest and Sinking Fund Requirements.	Cost of Maintenance and Operation.
	Per Cent.	Per Cent.
Boston,*	23.28	28.14
Dedham,	13.52	19.85
Hyde Park,	18.13	35.51
Milton,	45.07	16.50
Totals,	100.00	100.00

* Portions of West Roxbury and Dorchester districts.

SPECIAL FACTS AND CONDITIONS.

1. *Charles River System.*—It has been assumed, in making the foregoing apportionments, that the city of Boston would continue, under some contract or arrangement with the Commonwealth, to receive at Gainsborough Street the sewage collected by the Charles River main sewer, and to convey and discharge the same, through its own main sewer, to and at Moon Island. If, as authorized by the original act (St. 1889, c. 439), the latter sewer should be purchased or taken by the Commonwealth and incorporated with the Charles River system, the foregoing apportionments, both for the Charles River system and for the north metropolitan system, would undoubtedly need to be recast and adjusted to the new and materially changed facts and financial conditions which would then exist.

2. *Neponset River System.*—Authority is given in the act establishing this system (St. 1895, c. 406) for the taking by purchase or otherwise of that portion of the Dorchester intercepting sewer which lies between its Central Avenue terminus and Granite bridge. We are advised by the Board of Metropolitan Sewerage Commissioners that it has been decided to exercise this power at once, or as soon as a more adequate provision shall have been made for the entire cost of this system. We have framed the apportionment on the assumption that this course will be pursued. If for any unforeseen cause the plan should fail to be carried out, a revision of the apportionment for this system also would be necessary.

EDMUND H. BENNETT,

JOHN E. SANFORD,

EVERETT C. BUMPUS,

Apportionment Commissioners.

Upon March 4, 1886, the Board authorized the chairman to sign the following communication in behalf of the Board:—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, March 4, 1896.

To His Excellency the Governor and the Honorable Council.

Respectfully represents the Board of Metropolitan Sewerage Commissioners, created by chapter 439, Acts of 1889: that it organized in September of that year, and located its offices in the Ames building on Lincoln Street in Boston, which offices were leased for a period of three years from Oct. 1, 1889, with the priv-

ilege of extending the same for six months at the expiration of said time. That on March 10, 1893, said building, with others in that neighborhood, was totally destroyed by fire; and under the circumstances this Board, understanding that certain rooms in the extension of the State House (the same being the room now used for the council chamber, with the small ante-room on each side) had been assigned to them, applied to have them made available for use at the earliest possible moment practicable. This they were given to understand could be effected by September 1 of that year, and they accordingly engaged rooms in the Walker building, at 110 Boylston Street, for one year from March 15, 1893, at a rental of \$3,050, with a proviso that said lease might be terminated on August 31, or upon the last day of any month subsequent by giving thirty days' notice in writing. On September 1 the rooms in the State House extension that we had expected to occupy were unfinished, and we were compelled to remain in the Walker building, where the lease has been twice renewed, and will expire on the fourteenth instant.

The total floor area in the quarters assigned the Board in the extension of the State House is approximately three thousand square feet, and includes two large and commodious vaults. The rooms in the Walker building now occupied cover a total area of about twenty-eight hundred square feet, in which have been placed portable safes containing about forty cubic feet. We estimate that about two thousand square feet of floor space on the same or adjacent stories, with about three hundred cubic feet of vault room accessible thereto, would be necessary for our use.

Wherefore this Board prays your honorable body that suitable quarters may be assigned to it in the extension of the State House or other buildings of the Commonwealth.

Very respectfully yours,

(Signed)

HOSEA KINGMAN,
Chairman.

This petition was referred to the committee on State House of the council, who, after hearing this Board, made the following report, of which we were duly notified by the following communication : —

COMMONWEALTH OF MASSACHUSETTS,
COUNCIL CHAMBER, BOSTON, March 26, 1896.

The committee on State House, to whom was referred the communication from the Metropolitan Sewerage Commissioners asking that suitable quarters be assigned to them in some of the buildings

of the Commonwealth, after a conference with the State House Construction Commissioners and Sergeant-at-Arms, recommend the adoption of the following orders.

CHARLES E. STEVENS,
For the Committee.

Ordered, That the first, second and third stories of the building No. 1 Mt. Vernon Street be assigned for the temporary use of the Metropolitan Sewerage Commissioners, their engineer, secretary, officers, clerks and other employees.

Adopted in council March 26, 1896.

EDWARD F. HAMLIN,
Executive Clerk.

Ordered, That the Metropolitan Sewerage Commissioners be authorized to fit up and occupy the first three floors of building No. 1 Mt. Vernon Street, the cost of repairs to be paid from their contingent fund.

Adopted in council March 26, 1896.

EDWARD F. HAMLIN,
Executive Clerk.

A true copy. Attest:

(Signed)

E. F. HAMLIN,
Executive Clerk.

Upon receipt of the above, this Board notified Joseph Walker, the trustee of the property at 110 Boylston Street, which we then occupied, as follows:—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 110 BOYLSTON STREET,
BOSTON, April 1, 1896.

JOSEPH WALKER, *Trustee, 53 State Street, Boston, Mass.*

DEAR SIR:—I have sent your agents, Messrs. Whitcomb, Wead & Co., a check for the rent of rooms in the Walker building, 110 Boylston Street, in full to date, with a note that this Board would vacate said rooms on the thirtieth instant, and wish now to say to you that our reason for so doing is to save our rent.

Quarters have been assigned to us in a building owned by the Commonwealth and we shall remove there during the present month, so that the rooms we have been occupying will be at your disposal on May 1, 1896.

For the Board,

(Signed)

EDWARD P. FISK,
Clerk.

Quarters having been assigned to us in the building 1 Mt. Vernon Street, preparations were made to put it in suitable order for occupancy, the expense therefor amounting to about \$1,600; and preparations were made to have all the effects removed to the new office prior to the first of May, 1896, which was accomplished.

On May 9, 1896, the following petition was sent to His Honor the Lieutenant-Governor and Council:—

COMMONWEALTH OF MASSACHUSETTS,
METROPOLITAN SEWERAGE COMMISSIONERS, 1 MT. VERNON STREET,
BOSTON, May 9, 1896.

To His Honor the Lieutenant-Governor and the Honorable Council.

Respectfully represents the Board of Metropolitan Sewerage Commissioners that, since the occupation of house No. 1 Mt. Vernon Street by said Board, it is found that it is necessary to have more room in said house for the work of the Board.

Therefore said Board requests that it may have the use and occupation of the fourth and fifth floors in said house.

Very respectfully yours,

(Signed)

HOSEA KINGMAN,
Chairman.

To which we received the following reply:—

COMMONWEALTH OF MASSACHUSETTS,
COUNCIL CHAMBER, BOSTON, May 14, 1896.

HON. HOSEA KINGMAN, *Chairman Metropolitan Sewerage Commission.*

DEAR SIR:—I have the honor to inform you that at a meeting of the Executive Council, held this day, it was ordered that the entire building, No. 1 Mt. Vernon Street, be assigned for the use of the Metropolitan Sewerage Commission, and that the building No. 2 Mt. Vernon Street be assigned for the use of the Boston Transit Commission.

Respectfully yours,

(Signed)

E. F. HAMLIN,
Executive Clerk.

Here the office of the Board has remained, at an annual saving of over \$3,000.

The following communication speaks for itself:—

COMMONWEALTH OF MASSACHUSETTS,
OFFICE OF THE SECRETARY, BOSTON, Jan. 18, 1896.

EDWD. P. FISK, Esq., *Clerk Metropolitan Sewerage Commissioners.*

DEAR SIR:—I have the honor to inform you that on the ninth day of January, 1896, Hosea Kingman of Bridgewater was appointed and commissioned as a member of the Board of Metropolitan Sewerage Commissioners; and that on the sixteenth day of January, 1896, he took and subscribed the required oaths of office as such commissioner.

Very respectfully,

(Signed)

WM. M. OLIN,
Secretary of the Commonwealth.

This is his third appointment as a member of this Board, and upon the completion of said term he will have served ten years thereon.

At the annual meeting of the Board, held, as provided in the act (chapter 439, Acts of 1889), on the first Monday of February (February 3), 1896, Hosea Kingman of Bridgewater was again chosen chairman and Edward P. Fisk clerk for the year.

By chapter 68, Acts of 1892, and also sections 19 and 20 of chapter 407, Acts of 1895, the clerk of this Board, or whomsoever this Board may designate, is allowed to have advanced to him sums not exceeding \$10,000 at any one time from the sewerage loan fund in the treasury of the Commonwealth. No provision is made, however, for any such advance from appropriations made for maintaining and operating said systems; and, as the time is not far distant when the work of construction will be completed, we would recommend that an act authorizing similar advances from the appropriations for operating and maintaining these systems be passed.

The recommendations made in this report, summarized briefly, are: the addition of \$5,000 to the \$30,000 authorized by chapter 414, Acts of 1896, to meet the expenses incurred by adding a part of the town of Wakefield to the metropolitan sewerage system; also the passage of an act (copy submitted to the committee on metropolitan affairs,

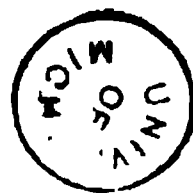
1896) authorizing the taking by this Board of the main trunk line of the Boston main drainage system, and making an appropriation therefor (the importance of this has been fully discussed by both this Board and the city authorities, and would, if passed, at once and forever put an end to all conflicting interests, and reduce the cost of maintenance to a minimum); an act authorizing the addition of \$300,000 to the \$500,000 appropriated by chapter 406, Acts of 1895, for the construction of the Neponset valley sewer; and an act authorizing advances to this Board or its representative from the maintenance funds of the various systems. These acts can be prepared and submitted to the committee of your honorable body authorized to report thereon.

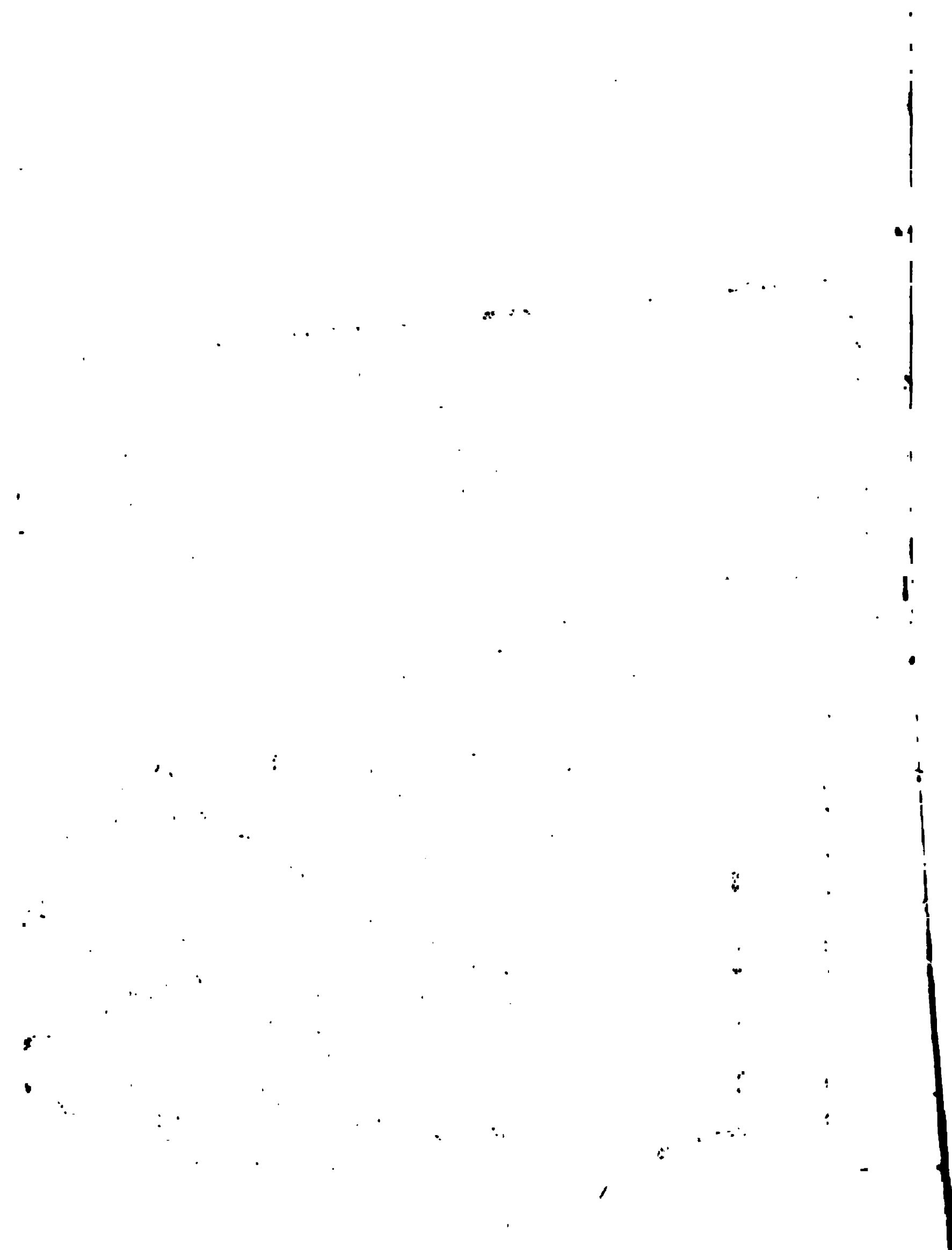
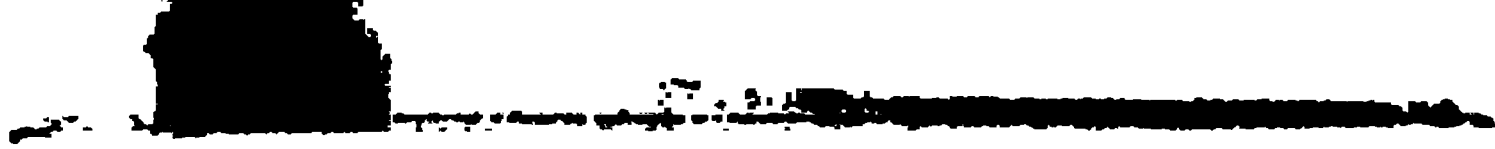
The Appendix contains tables showing in detail the receipts and expenditures for the year, also the assets and liabilities at date.

HOSEA KINGMAN,
TILLY HAYNES,
ALBERT F. NOYES,

Metropolitan Sewerage Commissioners.

Boston, Oct. 1, 1896.





REPORT OF CHIEF ENGINEER

AND

SUPERINTENDENT.

REPORT OF CHIEF ENGINEER

AND

SUPERINTENDENT.

BOSTON, Sept. 30, 1896.

HOSEA KINGMAN, TILLY HAYNES, ALBERT F. NOYES,
Metropolitan Sewerage Commissioners.

GENTLEMEN:— The annual report relating to construction and maintenance for the year ending Sept. 30, 1896, is respectfully submitted, as follows:—

The North Metropolitan System has been completed during the year. The coal- and screen-houses which were in process of construction at Deer Island, East Boston and Charlestown, at the close of last year, were completed early in the present year and have been in use since. The pumping plants at the large pumping stations have been formally tested and accepted. The permanent station and pumping plant at Alewife Brook have been in use since November last. A coal-house for this station is just completed. The grounds about all of the stations have been graded, and at Deer Island a heavy sea wall and riprap slope have been placed to defend the coast line fronting the station. The whole system has been in operation during the year, except for minor interruptions at the pumping stations during the formal tests of the pumping plants. It is now receiving through 54 connections the foul drainage from approximately 253.7 miles of local sewers in Deer Island, Winthrop, East Boston, Everett, Malden, Melrose, Medford, Winchester, Woburn, Arlington, Belmont, Cambridge and Somerville. The population now using these sewers is estimated at 98,703 persons. Charlestown, Chelsea and Stoneham, although within the North Metropolitan District, have not as yet made connection with the system.

Surveys have been made for a Wakefield branch of the North Metropolitan System, from the junction of Pleasant Street and

Wyoming Avenue in Melrose, at the end of Section 41, through Melrose to the Wakefield town line. Detailed plans and estimates of cost for this work have been prepared.

The Charles River System, which has been in operation since May 1, 1892, is now receiving through 36 connections foul drainage from approximately 208.4 miles of local sewers in a part of Boston (proper), Brookline, Brighton, Watertown, Newton and Waltham. The population now using these sewers is estimated at 50,540 persons.

In the Neponset Valley approximately 7 miles of intercepting sewer are now in process of construction, extending from Central Avenue in Dorchester to a point in Dedham beyond the Dedham Branch of the New York, New Haven & Hartford Railroad near the West Roxbury line. It is anticipated that this can be opened for service during the coming spring. It will discharge into the Dorchester Interceptor of the Boston Main Drainage System, and will provide for parts of Dorchester, Milton, Hyde Park and Dedham.

Detailed surveys and an estimate of cost for an extension of this interceptor through West Roxbury to near the Brookline town line have been made during the year.

A detailed statement relating to construction and maintenance during the year follows :—

PUMPING STATION, DEER ISLAND.

Location. — On the south-westerly side and about midway of Deer Island.

Day Work.

Assistants.

Assistant Engineer to April 1, 1896: Frederick D. Smith.

Foreman: Chris Rasmussen.*

Transitman: J. T. P. Jones.*

The work by day labor during the year is as follows :—

Grading grounds about the pumping station and tenement-house; laying a system of surface and house drains; improving graded slopes back of pumping station; constructing sea wall and road in front of the station; improving and cementing the riprap slope fronting the station; and miscellaneous work about the buildings and grounds.

Grading and Drainage. — The grading about the tenement-house involved stripping the loam and raising the surface from 2

* For a portion of the year.

to 4 feet. The loam was afterwards replaced and walks and drives made which were surfaced with beach gravel.

The location of the coal-house and screen-house required that considerable material should be taken away to ensure proper drainage. One hundred and fifty yards of hard pan were removed, the surface was covered with loam, and a system of drains introduced to remove roof- and surface-water. A drain from the tenement-house to the suction wells of the pumping station has also been laid. Cost of grading and drainage, \$875.

Slope Back of Station. — The steepness of the slope back of the station and its clayey nature necessitated special precautions to prevent sliding and washing of the loam surface. Timbers have been laid longitudinally at intervals, and the surface of the slope loamed and grassed over. Cost, \$75.

Sea Wall. — A sea wall, at the side of the road fronting the station, has been constructed for a distance of 360 feet easterly from the wharf to beyond the end of the station. It is built on a concrete base 3 feet wide by $3\frac{1}{2}$ feet deep below the street surface. The wall is of two courses of cut granite. The lower course is 2 feet wide by 2 feet high, and the upper course, or coping, has a rounded upper surface. Heavy granite newel posts finish the wall at either end. Total cost of wall, \$2,039.37.

Improving and Cementing Riprap Slope. — To tighten and strengthen the riprap slope fronting the station the joints have been filled with Portland cement grout, securely sealed against the heel of the sea wall, and otherwise improved. Cost, \$175.

Miscellaneous. — Unclassified items, including road-building, concreting cellars of tenement-house, etc., and other day work about the grounds, etc., aggregate in cost (including architect's fees) \$1,834.37.

Contract Work.

The following building contracts mentioned in the seventh annual report have been completed during the year : —

Coal-house and Screen-house.

Architect : Arthur F. Gray.

Inspector : Caleb Kimball.

Contractors : Mack & Moore.

Contractors' Foreman : L. F. Sykes.

Contract price : \$14,900.

The coal-house is a brick building agreeing in general architectural lines with the engine- and boiler-house and extending

westerly from the boiler-house to the wharf. It provides storage for 600 long tons of coal, and is connected to the end of the wharf by an elevated trestle.

The screen-house is of brick, and is located at the westerly end of the coal-house. It is two stories in height with a slated hip roof surmounted by a cupola. It covers the screen-shaft and contains the machinery for hoisting and pressing.

These buildings were completed Dec. 1, 1895, at a cost of \$15,023.31.

Dwelling-house.

Location.—About 150 feet south of the pumping station.

Architect: Ernest N. Boyden.

Inspector: Caleb Kimball.

Contractors:

Building.—Hersee Bros. of Roslindale; contract price, \$9,995.

Plumbing.—L. C. Watt of Boston; contract price, \$987.

This is a two-story wooden building for four tenements, with a main portion 71 by 30 feet and two wings 18 by 17 feet. Work was commenced on this dwelling Aug. 30, 1895, and was completed Jan. 25, 1896, at a cost of \$10,037.72 for the building and \$987 for the plumbing.

This house is now fully occupied by permanent employees of the pumping station.

Press for Screen-house.—A press for forming dry cakes, suitable to be burned under the boilers, from the collections removed from the screens, was built by Miller & Shaw of Cambridgeport, at a cost of \$195.

Table showing Total Cost of Deer Island Pumping Station and Connections.

Buildings.

Main building, Gooch & Pray,	\$24,485 25
Coal-house, coal-run and screen-house, Mack & Moore,	15,023 31
Tenement house:—	
General contract, Hersee Bros.,	\$10,037 72
Plumbing contract, L. C. Watt,	987 00
	11,024 72
	<hr/> \$50,533 28
Interior finish, engine-room:—	
Wood-work, Wm. Richmond & Co.,	\$2,110 00
Plastering, J. J. Ford & Co.,	275 00
Marble flooring, Philip H. Butler & Co.,	567 00
Iron floor work, Chelmsford Foundry Company,	556 70
Sub-floor of concrete (day work),	351 00
	<hr/> 3,859 70
Amount carried forward,	<hr/> \$54,392 98

Amount brought forward, \$54,392 98

Foundations and Connections.

Day work:—

3 pump-wells and foundations for 2 engines, including connections with discharge and low-level sewers,	\$24,546 50	
120 linear feet discharge sewer, 6 feet by 10 feet diameter, and building-foundation above it,	4,525 25	
86 linear feet low-level sewer (suction chamber), 8 feet by 13 feet, and building-foundation over it,	6,535 60	
150 feet low-level sewer, tunnel,	6,322 38	
Laying 6-inch water pipe,	2,304 18	
Salt-water well,	1,419 98	
Screen-chamber,	2,140 50	
Grading, retaining wall, riprap, etc.,	9,515 13	
		<hr/> 57,309 54

Machinery.

Engines, pumps and boilers, Edward P. Allis Company (including bonus),	\$55,000 00	
Screen-machinery,	2,266 73	
Heating and ventilating,	538 00	
		<hr/> 57,804 73

Miscellaneous.

Unclassified items, including piping, testing of pumping plant, teaming, etc.,	6,981 55	
		<hr/>

Total cost of Deer Island pumping station with two pumping engines and appurtenances; the total capacity for pumping being at the rate of 90,000,000 gallons per 24 hours for a lift of 19 feet, \$176,488 80

SECTION 7 (DAY WORK), WINTHROP AND EAST BOSTON.

Location.—From a point about 300 feet westerly from Pleasant-street station, on the Boston, Revere Beach & Lynn Railroad, across Belle Isle Inlet and Marsh Island to a point on the marsh in East Boston about 100 feet westerly from Riverside Avenue.

Overflow, Riprap and Grading.

Assistants.

Assistant Engineer: Frank I. Capen.

Foreman: Patrick McCarthy.

Transitman: William M. Stodder.

After the completion of contract work on Section 7 early in 1895, there remained to be constructed an overflow from the end of the sand-catcher on the East Boston shore; also an embankment requiring about 2,900 cubic yards of filling and 900 cubic yards of hand-laid riprap. When this work was completed the approaches to the siphon were left in a safe and sightly condition.

The overflow is a masonry channel 75 feet long, 8 feet wide and 6 feet high, with cut stone mouth; the whole is supported on piles and was built in coffer.

This grading and overflow work was carried out by day labor, and was approximately one-half completed Oct. 1, 1895. It was completed in December, 1895.

Total cost of overflow,	\$5,552 44
Total cost of riprap and grading,	5,466 51
	<hr/> \$11,018 95

PUMPING STATION, EAST BOSTON.

Location. — On the northerly side of Addison Street, about 300 feet from the corner of Chelsea and Addison streets, on the south side of Chelsea Creek, east of and adjacent to the Grand Junction Railroad location.

The work of construction at this station, except a few minor items, was completed prior to Sept. 30, 1895.

Sea Wall. — The sea wall at the westerly end of the boiler-house, partially finished last year, was completed in October, 1895. Contractor, W. H. Wyman of Chelsea ; cost, \$650.

Sidewalk and Grading. — A granite curb and a brick-paved sidewalk 10 feet wide have been completed at the front of the house. Contractors, A. A. Libby & Co. of Boston ; cost, \$236.74.

Addison Street from Chelsea Street to the easterly end of the station, and the grounds about the ends of the station, have been graded sufficiently to convey the surface- and roof-water away from the buildings and to put the grounds in a smooth and sightly condition. Cost, by day labor, \$350.

Hydraulic Lift and Press for Screen-house. — A hydraulic lift was built and erected by the Whittier Machine Company of Boston. This is capable of raising 600 pounds 16 feet, from the level of the screen-pit to screen-room floor. Cost, including wire enclosure, \$575.

A steam press for squeezing the material taken from the screens, into dry cakes in condition to be burned under the boilers, was built by Miller & Shaw of Cambridgeport, at a cost of \$155.

Table showing Total Cost of East Boston Pumping Station and Connections.

Buildings.			
Main building, E. E. Strout.	\$20,329 18		
Coal-house, W. T. Eaton,	4,610 80		
Screen-house, O'Connell & Furbish,	2,100 00		
	<hr/>	\$27,039 98	
Interior finish : —			
Wood-work, William Richmond & Co.,	\$1,789 00		
Plastering, J. J. Ford & Co.,	235 00		
Marble flooring, Philip H. Butler & Co.,	510 00		
Iron floor work, Chelmsford Foundry Company,	547 70		
	<hr/>	3,081 70	
Amount carried forward,			\$30,121 68

<i>Amount brought forward,</i>									\$30,121 68
<i>Foundations and Connections.</i>									
Foundations and connections, including screen-man-hole and chamber, suction-conduit, pump-wells and foundations for pumps, discharge-channels and connections with Section 9, sea wall, foundation walls for engine-house, chimney foundations, boiler foundations, wharf, salt-water well, dredging of berth for vessels, etc.,									
									67,830 45
<i>Machinery.</i>									
Engines, pumps and boilers, Edward P. Allis Company (including bonus),									
									\$57,000 00
Screen-machinery,									
									1,742 52
Heating and ventilating,									
									398 00
									59,140 52
<i>Miscellaneous.</i>									
Unclassified items, including piping, testing of pumping plant, teaming, architect's fees, etc.,									
									15,621 29
Total cost of East Boston pumping station with two pumping engines and appurtenances; the total capacity for pumping being at the rate of 90,000,000 gallons per 24 hours for a lift of 19 feet,									
									\$172,713 94

PUMPING STATION, CHARLESTOWN.

Location. — The Charlestown pumping station is located on the easterly side of the Malden Bridge causeway, at the northerly end of the pile structure on what is known as Alford Street, Charlestown.

The foundations for the coal-house at this station were completed by day labor last year. During the present year a brick coal-house with a capacity of 300 long tons has been constructed; the interior finish of the station completed; a heating, ventilating and electric light plant installed; and the grounds about the station graded.

Coal-house.

Architect: Arthur F. Gray.
Inspector: James E. Coyne.
Contractors: Mack & Moore of Boston.
Contract price: \$7,400.

The coal-house is located just north of the boiler-house on Alford Street. It is a brick structure, 32½ feet square. The walls are about 17 feet in height, covered with a slated hip roof surmounted by a cupola. The brick and slate match those of the main building. The work of construction was completed Jan. 1, 1896, at a cost of \$7,497.

Interior Finish.

The interior finish in the engine- and toilet-rooms consists of dado, doors and window trimmings of oak; tinted, adamant-plastered walls; and granolithic and iron floor. The boiler-room and screen-room are finished in pine with painted walls.

The detailed cost of this work is as follows:—

W. H. Keyes & Co. of Boston, interior wood-work,	\$1,857 75
John Mack of Boston, plastering, in accordance with contract,	267 00
Aberthaw Construction Company of Boston, laying 1,819 sq. ft. of granolithic flooring (including labor and materials) at 14 cents per sq. ft.,	254 66
Chelmsford Foundry Company of Boston, iron floor work,	956 20
	<hr/>
	\$3,335 61

Heating and Ventilating.

The apparatus consists of a 42-inch steel exhaust-fan operated by a direct-connected vertical engine of 3½-inch cylinder and 8-inch stroke, together with a sectional heater having radiating capacity of 1,176 linear feet of 1-inch pipe, with necessary galvanized-iron piping for conveying hot air to engine- and toilet-rooms. The whole was furnished and erected by the Walworth Construction and Supply Company of Boston, at a cost of \$405.

Electric Lighting.

The dynamo and engine installed were used during the construction of the tunnel under the Mystic River. They have been thoroughly repaired and much improved.

The dynamo is a direct-current Westinghouse machine, with a capacity of 60 incandescent lights at 110 volts. The engine is an automatic Ideal, with 5-inch cylinder and 6-inch stroke.

The station has been wired for 55 lights in circuits to the engines, boilers, coal-house, screen-house and toilet-rooms, controlled from switches in the dynamo-room.

The wiring and electric work was done by Wilkinson & Feldman of Boston, at a cost of \$226.

Grading.

The grounds about the station have been graded to a general agreement with the grades of Alford Street. To protect the masonry wall of the boiler-house, fronting on Alford Street, a fend-log of 12 by 12-inch hard pine has been placed in line with and extended to the fend-log of Malden Bridge. Cost of grading and fend-log, \$497.

Table showing Total Cost of Charlestown Pumping Station and Connections.

<i>Buildings.</i>			
Main building, Edward Lynch & Co.,	\$18,171 31		
Coal-house, Mack & Moore,	7,497 00		
	<hr/>	\$25,668 31	
Interior finish :—			
Wood-work, W. H. Keyes & Co.,	\$1,857 75		
Plastering, John Mack,	267 00		
Granolithic flooring, Aberthaw Construction Company,	254 66		
Iron floor work, Chelmsford Foundry Company,	956 20		
	<hr/>	3,335 61	
		<hr/>	\$29,003 92
<i>Foundations and Connections.</i>			
Day work :—			
3 pump-wells,	\$44,520 00		
3 inspection- and valve-man-holes,	9,850 00		
Discharge channels to main sewer,	20,700 00		
Foundations for main building,	4,880 00		
Foundations for chimney,	900 00		
Foundations for boilers,	1,000 00		
Foundations for coal-house,	2,675 00		
Sea wall,	15,600 00		
Screen-man-hole,	8,760 00		
Miscellaneous,	8,800 00		
	<hr/>	\$117,685 00	
Contract work :—			
Dredging and fender piles, Josiah Shaw,	1,291 00		
	<hr/>		118,976 00
<i>Machinery.</i>			
Engines, pumps and boilers, Edward P. Allis Company (including bonus),	\$38,000 00		
Screen-machinery,	1,600 00		
Electric wiring and fittings,	226 00		
Heating and ventilating,	405 00		
	<hr/>		40,231 00
<i>Miscellaneous.</i>			
Unclassified items, including piping, grading, etc.,			11,543 10
			<hr/>
Total cost of Charlestown pumping station with two pumping engines and appurtenances; the total capacity for pumping being at the rate of 45,000,000 gallons per 24 hours for a lift of 11 feet,			\$199,754 02

SECTION 35, CHARLESTOWN, SOMERVILLE AND MEDFORD.

Location. — From Alford Street, at Arlington Avenue, Charlestown, through Arlington Avenue, across the Grand Junction and Boston & Maine Railroad tracks and through Mousal Place to North Union Street; thence through private land to Mystic Avenue near Austin Street, and through Mystic Avenue to a point in Medford a few feet beyond the Somerville and Medford line.

Assistant Engineer: Frank I. Capen.

Transitman: G. A. Winsor.

Contractors: James Heath & Son of Lynn, Mass.

The work at the upper end of this section remaining to be completed Sept. 30, 1895, about 500 feet of sewer 1 foot 10 inches by 2 feet 3½ inches, was finished in January, 1896, and the section was cleaned and opened for service.

The amount of the final estimate for this section was \$77,237.97.

SECTION 38, EAST BOSTON.

Location. — From a point in Bremen Street, about 300 feet south of Brooks Street, through Bremen, Decatur, Orleans, Maverick and Jeffries streets to Sumner Street; also a branch from corner of Maverick and Orleans streets, through Orleans and Marginal streets to about 800 feet beyond Cottage Street.

Assistant Engineer: Seth Peterson.

Contractors: James Heath & Son of Lynn, Mass.

At the beginning of the year minor repairs remained to be finished on this section. In Orleans and Marginal streets, near the upper end of the section, the Metropolitan Sewer consists of 15-inch and 18-inch pipe. A length of 20 feet of 15-inch pipe on Orleans Street was found to be badly cracked, and a length of 190 feet on Orleans and Marginal streets was leaking badly. After having been duly notified, the contractors failed to make the necessary repairs and the work was carried out by day labor at the contractors' expense. Total cost of repairs, as outlined above, \$748.52.

The cost of repairs to the city of Boston Sewer on Bremen Street, injured by the contractors' operations, and paving on Orleans and Marginal streets, yet remains to be adjusted on this section.

The final estimate on this section was for \$45,132.35.

ALEWIFE BROOK PUMPING STATION, NORTH SOMERVILLE.

Location. — On the easterly side of Alewife Brook, about 350 feet from the Mystic pumping station of the Boston Water Works.

At the date of the last annual report the station itself was nearly completed. The walls were built and the roof partially slated. The building was finished early in November, 1895. It has been occupied and the pumping plant has been in operation since the end of that month. During the year a riprap slope has been constructed on the bank of Alewife Brook, at the rear of the station; the grounds about the station have been graded; granolithic flooring has been laid in the engine-room and boiler-room; and a coal pocket has been substantially completed.

Coal-pocket. — The pocket is located just north of the boiler-room. It is sunken below the surface, so that its floor is approximately level with the boiler-room floor, and the roof is finished even with the graded surfaces about the station. Four iron hatches in the roof allow coal to be dumped directly from carts into the pocket.

Its dimensions are 40 feet long by 28 feet wide by 6 feet deep. The walls and floor are of Portland concrete, and the roof, supported by iron I-beams, consists of 4-inch brick arches covered with Portland concrete and $1\frac{3}{4}$ inches of asphalt pavement.

The capacity of the pocket is 150 long tons. Total estimated cost, \$2,100.

Riprap Slope and Grading. — The riprap slope at the rear of the station, and the grading of the grounds about the station, cost \$400.

Granolithic Flooring. — The granolithic flooring was laid by the Aberthaw Construction Company of Boston, at a cost of \$104.64.

Miscellaneous. — Iron covers for the suction wells and screen-man-hole cost \$150.

Foundations for condensing and feed pumps cost \$38.

Pipe-fittings, valve-mechanism in screen-man-hole, and discharge pipes and valves, and miscellaneous iron and piping work about the station, cost \$1,823.04.

Pumping Plant.

The station has been designed for four units, two being installed at present. The pumps used are Andrews 9-inch centrifugal, with a maximum capacity of 8 cubic feet per second. The suction pipes are of iron, 10 inches diameter, terminating in a bell 15 inches diameter at the bottom. No foot-valves are used, the pumps being primed by exhausting the air into the condenser. Check-valves on the discharge pipes prevent sewage from running back through the pumps. The pumps are direct-connected to compound-condensing engines of marine type and of about 25 horse-power each, with cylinders 5 inches and 10 inches by 7-inch stroke, running at speeds varying from 280 to 325 revolutions per minute, according to the lift and the quantity pumped.

The engines have cranks hung opposite, to lessen vibration as much as possible. The valves are of the piston-type, with fixed cut-off. An ordinary throttling governor is provided to control the engine in case a pump loses its charge. Should it be desired to run at less than the full capacity of one pump, the steam is throttled or the boiler run at reduced pressure.

The engines were built by the Fore River Engine Company of Weymouth, Mass., and cost (erected) \$775 each. The pumps were originally purchased for use on the work of construction, and cost \$550 each.

The condensing apparatus consists of two Deane independent vacuum pumps, $3\frac{1}{2}$ inches by 6 inches by 5 inches, connected to a single condenser-bell. The exhaust from the low-pressure cylinders is passed through a Jacobs feed-water heater before reaching the condensers.

The boilers are two in number, of the vertical, tubular type, made with extra high fire-box to allow good combustion of bituminous coal. They are of 48-inch diameter and 12 feet 6 inches high, and contain 100 tubes 2 inches by 6 feet. The fire-box is 42 inches in diameter and 50 inches in height, stayed with 1-inch stay-bolts spaced 5 inches on centres. The boilers are 30 horsepower each, and were designed for a working pressure of 150 pounds per square inch, but are ordinarily run at 125 pounds. The main damper is operated by a Locke damper-regulator.

Two feed pumps of the Deane duplex type, 3 inches by 2 inches by 3 inches each, are provided, together with an injector for an auxiliary feed.

A fixed screen is provided in the low-level sewer, in advance of the suction pipes for pumps, so arranged that any matter collecting on it can be easily raked off.

The screen bars are $\frac{3}{4}$ of an inch diameter, spaced 1 inch apart in the clear.

The design of this station is such that the necessary attendance is reduced as far as possible; one man on each shift is at present sufficient for all the work of running engines and boilers. Outside assistance is required only for the disposal of ashes and matter from the screens.

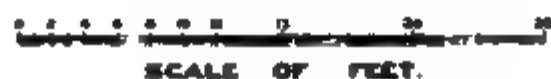
Table showing Total Cost of Alewife Brook Pumping Station and Connections.

Building (contract of W. T. Eaton of Boston),	\$5,719 00
Foundation, pump-wells and 160 linear feet of 3 feet by 3 feet 6 inches connecting sewer (day work),	8,443 33
Coal-pocket (day work), estimated,	2,100 00
Engines,	1,550 00
Boilers,	1,135 00
Feed and condenser pumps and miscellaneous piping,	1,823 04
Miscellaneous unclassified items, including grading, etc.,	2,082 12

Total cost of Alewife Brook pumping station with two pumping engines and appurtenances; the total capacity for pumping being at the rate of 10,000,000 gallons per 24 hours for a lift of 13.6 feet, \$22,852 49

PLATE A

SECTION THROUGH PUMP. DEER ISLAND STATION.



SCALE OF FEET.

PUMPING ENGINE TRIALS.

The complete pumping plants, including pumps, engines, boilers, piping and all accessories at the three pumping stations at Deer Island, East Boston and Charlestown, were furnished by the Edward P. Allis Company of Milwaukee, Wisconsin.

Deer Island and East Boston Plants. — The general arrangements at the Deer Island pumping station are shown on the accompanying plates (A and B).

The plants at Deer Island and East Boston are of the same capacity and design, and may be described as follows: —

The pumps are of the centrifugal type, with impellers, 8 feet 8 inches in diameter, revolving in a horizontal plane. The discharge pipes are 48 inches in diameter. The suction pipes are bell-shaped, being 66 inches in diameter at the bottom and tapering to 42 inches at the upper end near the pump case. The smallest cross-section of the passages through the impellers is 10 inches wide by 14 inches high, allowing the easy passage of anything that may have passed the screens. The main shafts are vertical, and the weight of impeller, shaft and crank is borne by a thrust-bearing under the main frame of the engine. The engines are horizontal, triple-expansion, condensing, with cylinders of $13\frac{1}{2}$ inches, 24 inches, and 34 inches diameter by 30-inch stroke. They are set so that the centre lines of adjacent cylinders form an angle of 60° .

The valve-gear is of the well-known Reynolds-Corliss type, all three wrist-plates being driven from a single eccentric.

The valve-gears of the intermediate and low-pressure cylinders are provided with adjustable trip cut-offs, which can be set by hand while the engine is running. The high-pressure valve-gear is controlled by an automatic governor, capable of adjustment while running, to give the different engine-speeds that are needed to pump at various lifts and rates of discharge. The valves of the high-pressure and intermediate cylinders are placed in the cylinders in the usual way. The valves of the low-pressure cylinders are placed in the cylinder-heads, in order to reduce clearance space as much as possible. All the cylinder-barrels and the heads of the high-pressure and intermediate cylinders, as well as the receivers, are jacketed with steam at boiler pressure.

The condensers are of the jet type, the single-acting air pump having a diameter of 11 inches and a stroke of 30 inches. The air pump is driven direct by a tail-rod from the intermediate piston. The drip from the jackets is discharged through a Flinn trap into

a small tank, where it is mixed with sufficient fresh water from the city mains to make up the feed, and then returned to the boilers by a small plunger pump actuated by an eccentric on the main shaft. A pair of ordinary, direct-acting, duplex feed-pumps and an injector are also provided for auxiliary boiler-feed.

The boilers are four in number, of the horizontal, return-tubular type, 60 inches diameter and 16 feet long, with 58 tubes, $3\frac{1}{2}$ inches diameter, in each. The heating surface of each boiler is 1,000 square feet.

The grates are of the shaking and dumping type, and have an area of 15.75 square feet for each boiler.

The flue gases are passed through a Green economizer containing 144 tubes, equivalent to about 1,600 square feet of heating surface. A small auxiliary engine is provided for the purpose of running the scrapers of the economizer.

Locke damper-regulators are provided for operating the main dampers.

Charlestown Plant. — The plant at this station is similar to the Deer Island and East Boston plants. The engines and pumps are of the same general construction, but are smaller. The engine cylinders are $9\frac{1}{4}$ inches, $16\frac{1}{2}$ inches and 23 inches diameter by 30-inch stroke. The air-pump is double-acting, 7 inches diameter and 30-inch stroke. The impellers of the pumps are 7 feet 6 inches diameter. The discharge pipes are 36 inches diameter, and suction pipes vary in diameter from 54 inches at the bottom to a minimum of 36 inches near the pump case.

The boilers are two in number, similar in every way to those at the other stations, except that they are 15 feet long, instead of 16 feet, and contain 940 square feet of heating surface each.

The economizer contains 96 tubes, with about 1,050 square feet of heating surface.

The contract for the pumping plant at the Charlestown pumping station contained a special provision that each of the engines at that station must be capable of raising to lifts up to 30 feet quantities of sewage inversely proportional to such lifts. This was for the purpose of pumping out the tunnel under Mystic River, whenever it should be necessary to do so, to avoid the necessity of installing a special plant for that purpose. The pumps were tested, and were found to be able to perform this service either with the shell of the pump unloaded or loaded externally with water.

PLATE B



VIEW OF ENGINE NO. 2.

DEER ISLAND.

Contract Requirements.

The contracts contained a provision that each engine should be subjected to trials for capacity and duty, at the expense of the Commonwealth. The conditions to be maintained during the trials were to be as near as practicable those given below. The elevations are in feet, and are referred to a datum about 100.64 feet below mean low water of Boston harbor.

The water to be pumped in the trials was to be either salt water, fresh water or sewage, but was not to contain more than one-half of one per cent. by weight of mineral and organic matter in suspension. Before reaching the suction pipe it was to be screened by a screen having apertures not greater than one inch, measured horizontally.

Trials of Maximum Capacity.

	PUMPING STATIONS.		
	Deer Island.	East Boston.	Charles-town.
Quantity to be pumped (cu. ft. per sec),	70.00	70.00	35.00
Elevation of the surface of water in the pump-well while pumping the above quantity (feet),	96.10	92.40	91.00
Elevation of surface of water in discharge channel, beyond outer end of discharge pipe of pump, while pumping the above quantity (feet),	115.10	111.40	102.00
Lift (difference between last two elevations) (feet),	19.00	19.00	11.00
Trial to be made of each engine separately,	With any 2 boilers.	With any 2 boilers.	With either boiler.
Minimum capacity (cu. ft. per sec.),	15.00	15.00	8.00

Duration of maximum-capacity trial to be determined by the Engineer, and to be not less than 12 hours. The quantity discharged to be determined by weir measurement. Such trials of minimum and intermediate capacity and such trials with lifts greater than the above shall be made as the Engineer thinks necessary.

Duty Trials of Engines and Boilers combined. — To be measured in foot-pounds for each 100 pounds of Georges Creek Cumberland coal, of the best quality, burned. No allowance to be made for ashes or partly consumed coal.

Test to be made with running start and clean fire, 3 inches thick, and to be finished with a fire in a similar condition and engine running.

Foot-pounds of work to be found by multiplying the number of pounds of water pumped by the vertical distance, in feet, between the level in the pump-well and that in the discharge channel, at a point as near as practicable to the end of the discharge pipe of the pump. The quantity discharged to be determined by weir measurement. These trials to be designated "24-hour coal-duty trials."

Twenty-four-hour Coal-duty Trials.

	PUMPING STATIONS.		
	Deer Island.	East Boston.	Charlestown.
Quantity to be pumped (cu. ft. per sec.), . . .	70.00	70.00	35.00
Elevation of surface of water in pump-well while pumping the above quantity (feet), . . .	96.10	93.50	91.00
Elevation of surface of water in discharge channel beyond outer end of discharge pipe while pumping the above quantity (feet), . . .	107.10	108.50	99.50
Lift (difference between last two elevations) (feet),	11.00	15.00	8.50
Trial to be made of each or either engine by itself, as the Engineer may decide.	Either 1 or 2 boilers.	Either 1 or 2 boilers.	Either boiler.

Duration of trial to be not less than 24 hours.

Duty Trials of Engines alone. — Duty to be measured by number of foot-pounds of work for each 1,000,000 British thermal units consumed. Number of heat units to be determined in substantial accordance with method recommended by Duty Trial Committee of American Society of Mechanical Engineers, recorded in Vol. XII. of its Transactions. Duration of trial, 10 hours for each or either engine.

These trials to be designated “heat-unit trials of engines.” The elevations, lift, rate of pumping and weir measurement to be as in the “24-hour coal-duty trials.”

Payments. — If the whole plant at any station be otherwise acceptable, and if the duty developed by said plant in the 24-hour coal-duty trials shall exceed the duty guaranteed by the contractor, a bonus shall be paid above the contract price for said plant; but, the whole plant at any station being otherwise acceptable, if the duty developed by said plant in the 24-hour coal-duty trials shall fall short of the duty guaranteed by the contractor, a fine shall be deducted from the contract price for said plant.

The bonus or fine to be calculated by the following formulæ : —

Deer Island Pumping Station.

Bonus = $\frac{\$3,800,000}{\text{Number of million foot-pounds guaranteed.}}$

Fine = $\frac{\$5,300,000}{\text{Number of million foot-pounds developed.}}$

$\frac{\$3,800,000}{\text{Number of million foot-pounds developed.}}$

$\frac{\$5,300,000}{\text{Number of million foot-pounds guaranteed.}}$

East Boston Pumping Station.

Bonus = $\frac{\$5,000,000}{\text{Number of million foot-pounds guaranteed.}}$

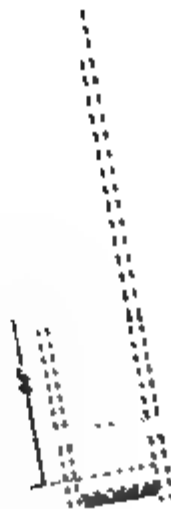
Fine = $\frac{\$7,000,000}{\text{Number of million foot-pounds developed.}}$

$\frac{\$5,000,000}{\text{Number of million foot-pounds developed.}}$

$\frac{\$7,000,000}{\text{Number of million foot-pounds guaranteed.}}$

PLATE C

111



PLAN OF PUMPING STATION.
DEER ISLAND.



Charlestown Pumping Station.

Bonus

=

\$1,800,000

Number of million foot-pounds guaranteed.

—

\$1,800,000

Number of million foot-pounds developed.

Fine

=

\$1,800,000

Number of million foot-pounds developed.

—

\$1,800,000

Number of million foot-pounds guaranteed.

But no bonus shall be paid in excess of the following sums :—

Deer Island pumping station,	\$8,000
East Boston pumping station,	10,000
Charlestown pumping station,	3,000

In case the duty developed by the whole plant at any station in either of the trials should fall short of the guaranteed duty by more than 10 per cent., such plant might be rejected.

In the 24-hour coal-duty trials, and in the heat-unit trials of engines, the duty guaranteed by the contractor was as follows :—

Deer Island pumping station,	75,000,000 foot-pounds.
East Boston pumping station,	75,000,000 foot-pounds.
Charlestown pumping station,	70,000,000 foot-pounds.

The contract prices for the pumping plants, not including bonus, were as follows :—

Deer Island pumping station,	\$47,000
East Boston pumping station,	47,000
Charlestown pumping station,	35,000

Description of Apparatus and Method of conducting Pumping Engine Trials.

The pumping stations at Deer Island, East Boston and Charlestown are alike in their general plan, but a difference in their surroundings causes a different grouping of parts at each place. The sewage approaches the pumping stations in the low-level sewers, or suction-channels, and leaves them in the high-level sewers, or discharge-channels. These channels are connected with the pump-wells. The third pump-well at each station is now unoccupied, and it was decided to place there the weir by which the discharge of the pumps was to be measured. The general arrangement at the Deer Island pumping station during the tests is shown on the accompanying plate C. A bulkhead was built in the high-level sewer and another in the low-level sewer. A temporary connection at a suitable elevation was made between the third pump-well and the low-level sewer, and the ordinary connection between them was bricked up. Thus the portion of the low-level

sewer between the pumps and the bulkhead was made a tank from which the sewage was pumped and discharged into the high-level sewer, where the upper bulkhead diverted it towards the third pump-well, whence it passed over the weir and flowed back to the suction-channel, to be pumped again over the same circuit. Provision was made for regulating the lift of the pumps by admitting water from the harbor into the suction-channel, or by pumping water out of it.

The liquid pumped during the tests consisted of sewage mixed with the water from the harbor. Samples of the liquid were collected at regular intervals during the tests and their temperatures noted. The specific gravity and weight per cubic foot of the liquid were afterwards determined by Prof. Henry Carmichael of Boston, Mass., analytical and consulting chemist.

The weir and channel of approach were constructed of yellow pine. The weir was vertical and at right angles to the general direction of flow. The crest was a carefully planed wrought-iron plate, flush with the back of the weir, extending entirely across the channel of approach. It was set level and presented a square edge, over which the water flowed with complete vertical contraction, as over a thin plate. The lateral contractions were suppressed. Channels of communication of large size were provided between the external air and the space beneath the sheet of falling water, to equalize the atmospheric pressures on each side of the sheet.

The sides of the channel of approach and the back of the weir below the iron crest were made tight with cement plaster, which was carefully worked to smooth surfaces.

A stilling-rack was placed in the channel of approach about 6 feet back of the weir. The rack was made of planed boards with tapered edges, placed vertically, parallel with the sides of the channel, and spaced about $\frac{7}{8}$ of an inch apart.

A bronze plate was inserted in each side of the channel, with its face flush with the face of the channel. The plates were at mid-depth of the stream and 4 feet 2 inches back of the weir. A sharp-edged circular orifice, bored at right angles to the face of each plate, formed the inlet to a pipe leading to the gauge-box. The orifices and pipes were 3 inches in diameter. A valve was put in each pipe, to control any excessive oscillations of the water.

The gauge-boxes were divided into 2 compartments by a partition reaching nearly to the bottom of the box. The hook-gauges were set in the compartments nearest the weir. The other compartments were occupied by the copper floats of other gauges.

The hook-gauges used in the duty trials were divided into feet

and hundredths, and had verniers reading to thousandths. A bench formed of an iron bolt of suitable shape was established in each gauge-box. The elevation of this bench was determined by direct levelling from the crest of the weir. The point of the hook was then set at the level of the bench by means of a very sensitive spirit-level, and the vernier was adjusted so that the point of the hook should coincide with the level of the crest of the weir when the reading of the gauge was zero. The zero-marks of the hook-gauges were tested before and after each trial, and sometimes during the trials.

Other gauges, in more convenient positions, were also established for watching the general steadiness of the flow. Dial-gauges were used for this purpose at Deer Island and East Boston. They were actuated by a float and weight connected by a cord passing over a pulley. The dial-gauges were not depended upon for accurate observations.

The weir at the Charlestown pumping station was at a great distance below the engine-room floor, and it was decided to use there, instead of dial-gauges, vernier-gauges, consisting of a float carrying a light rod of brass tubing, with an adjustable vernier which moved by the side of a rule attached to a firm support. The vernier read to thousandths of a foot. The motion of the vernier indicated the steadiness of the flow. When it was desired to observe the elevation of the water in the gauge-box by this apparatus, the rod was seized and held firmly by a clamp consisting of two wooden blocks with handles which were grasped by the hand. The accuracy of these gauges was found to be very great,—much greater than that of the dial-gauges. The level of the water was rarely constant, and it was found that the readings of the vernier-gauges agreed sensibly with those of the hook-gauges; which latter had to be set at a given instant to a moving surface.

The dimensions of weirs used in the duty trials were as follows:—

PUMPING STATIONS.	Length of Crest (Feet).	Distance from Crest to Floor (Feet).
Deer Island,	9.989	4.84
East Boston,	9.988	4.80
Charlestown,	7.992	6.98

The formula of Fteley and Stearns was used in computing the discharges over the weir. This formula allows corrections to be made separately for contraction and for velocity of approach.

Some of the experiments made at the time the formula was established also indicate corrections that may be made when the velocities are abnormally distributed. After applying corrections that seemed to correspond most nearly to the conditions obtaining in these trials the formula became : —

$$Q = 3.31 L (H + c h)^{\frac{3}{2}} + 0.007 L$$

$$c = 1.868 - 0.122 H,$$

in which —

Q is the discharge in cubic feet per second,
 L is the length of the weir in feet,
 H is the observed depth on the weir in feet,
 h is the head due to the mean velocity of approach in feet,
 c is a coefficient.

The gauges used in measuring the elevations of the water in the suction and discharge channels each consisted of a copper float carrying a long rod provided with an adjustable index, which traversed the face of a scale divided into feet and hundredths.

The trials were carried out under the immediate direction of Charles H. Swan and Winslow Blanchard, assistant engineers. The contractors were represented by J. H. Lewis, Mechanical Engineer. The observers were employees of the Board.

The readings of steam-, receiver- and vacuum-gauges, engine-counters, temperatures of cold feed, feed entering economizer and feed entering boilers were taken every fifteen minutes during the trials. All gauges and thermometers were carefully compared with standards, and the necessary corrections were applied.

The scales for weighing the coal and feed-water were tested by standard weights, and the necessary corrections were applied.

The readings of the weir-gauges were taken every 5 minutes. The readings of the gauges on the suction and discharge channels were taken every 15 minutes. Samples of the water pumped were taken at regular intervals and the temperatures were noted.

For the 10-hour heat-unit trials the condensed water from the cylinder and receiver jackets was allowed to run to waste, and corrections were made for this loss of heat based on observations of the rise in temperature of the cold feed-water after mixing with the jacket-drip during the 24-hour coal-duty trials.

The feed-water was taken directly from the city mains and sent through the economizer into the boilers. The temperatures used for computing the heat units were those of the cold city water, no allowance being made for heating of the feed by the economizer. The amount of moisture in the steam was assumed to be 1 per cent., this being based on recorded tests on similar boilers in practically the same conditions.

The same water being pumped repeatedly over the weir, carefully conducted experiments were made to determine approximately the amount of free air present in it. The effect of a considerable amount of free air in this water would be to increase somewhat the calculated duty of the pumps. The experiments indicated the presence of such a minute quantity of air that no correction was deemed to be necessary for it.

Results of Trials.

The pumps and engines operated smoothly and satisfactorily throughout the trials. The capacities, duties and amounts to be paid for the plants as determined are as follows : —

	PUMPING STATIONS.		
	Deer Island.	East Boston.	Charlestown.
Capacity required by contract,	70.00 cu. ft. per sec. raised 19 feet.	70.00 cu. ft. per sec. raised 19 feet.	35.00 cu.ft. per sec. raised 11 feet.
Capacity developed during tests :—			
Engine No. 1,	76.47 cu. ft. per sec. raised 19.45 feet.	73.66 cu. ft. per sec. raised 19.55 feet.	37.79 cu.ft. per sec. raised 11.41 feet.
Engine No. 2,	72.54 cu. ft. per sec. raised 19.42 feet.	73.99 cu. ft. per sec. raised 19.59 feet.	38.06 cu.ft. per sec. raised 11.61 feet.
Mean capacity developed, .	74.51 cu. ft. per sec. raised 19.44 feet.	73.83 cu. ft. per sec. raised 19.57 feet.	37.93 cu.ft. per sec. raised 11.51 feet.
Duty guaranteed by contract,	75,000,000 foot-pounds.	75,000,000 foot-pounds.	70,000,000 foot-pounds.
Duty developed during tests :—			
Engine No. 1,	93,761,973 foot-pounds.	91,104,390 foot-pounds.	92,025,790 foot-pounds.
Engine No. 2,	95,867,476 foot-pounds.	92,458,975 foot-pounds.	87,420,338 foot-pounds.
Mean duty developed, . . .	94,814,724 foot-pounds.	91,781,682 foot-pounds.	89,723,074 foot-pounds.
Bonus corresponding to mean duty developed,	\$10,589 00	\$12,190 00	\$4,082 60
Maximum bonus allowed by contract,	8,000 00	10,000 00	3,000 00
Contract prices, not including bonus,	47,000 00	47,000 00	35,000 00
Amounts to be paid for each plant,	55,000 00	57,000 00	38,000 00

In comparing these results with those derived from other engines, it should be remembered that the pumps are of the centrifugal type of unusual size, the impellers, or centrifugal fans, being 8 feet 3 inches in diameter at Deer Island and East Boston, and 7 feet 6 inches in diameter at Charlestown. It will further be noted that the duties developed approach the duties of modern,

high-grade piston pumps, and indicate a high degree of perfection in the design and workmanship of the plants. The purpose of the capacity trials being merely to determine whether the plants could easily meet the contract requirements, no attempt was made to attain their limit of capacity. The results of the trials are given more in detail in the following tables : —

Results of Capacity Trials.

	PUMPING STATIONS.					
	DEER ISLAND.		EAST BOSTON.		CHARLESTOWN.	
	Engine No. 1.	Engine No. 2.	Engine No. 1.	Engine No. 2.	Engine No. 1.	Engine No. 2.
Date of trial,	April 1, 1895.	April 22, 1895.	April 9, 1895.	April 10, 1895.	May 8, 1896.	May 9, 1896.
Duration (hours),	12	12	12	12	12	12
Average discharge, Q (cu. ft. per sec.),	76.47	72.54	73.66	73.99	37.79	38.06
Average lift (feet),	19.45	19.42	19.55	19.59	11.41	11.61
Ratio of Q to contract,	1.0924	1.0363	1.0520	1.0570	1.0800	1.0670
Ratio of lift to contract,	1.024	1.022	1.029	1.031	1.037	1.055
Ratio of work to contract,	1.116	1.060	1.080	1.090	1.119	1.148

Results of Coal-duty Trials.

	PUMPING STATIONS.					
	DEER ISLAND.		EAST BOSTON.		CHARLESTOWN.	
	Engine No. 1.	Engine No. 2.	Engine No. 1.	Engine No. 2.	Engine No. 1.	Engine No. 2.
Date of trial,	Feb. 27, 1896.	March 2, 1896.	Feb. 6, 1896.	Feb. 10, 1896.	May 16, 1896.	May 18, 1896.
Duration (hours),	24	24	24	24	24	24
Average discharge (cu. ft. per sec.),	72.65	73.13	74.40	73.26	37.99	37.85
Average lift (feet),	11.52	11.55	15.43	15.54	8.89	9.02
Weight per cubic foot of water pumped (pounds),	62.7614	62.7593	62.9630	62.9260	62.9837	62.9760
Net work done in pumping water (foot-pounds),	4,539,017,105	4,579,589,347	6,245,205,934	6,189,236,686	1,839,595,555	1,856,546,154
Net horse-power of water [=total foot-pounds ÷ (24 × 60 × 33,000)],	95.50	96.50	131.42	130.00	38.60	39.10
Indicated horse-power of engine,	160.00	155.30	231.20	238.07	76.00	76.00
Ratio of net horse-power of water to indicated horse-power of engine,	0.597	0.621	0.568	0.546	0.508	0.521
Total coal burned (pounds),	5,172	4,954	7,091	6,925	2,050	2,161
Per cent. of moisture in coal,	5.5	3.6	3.3	3.3	2.4	1.7
Total dry coal burned (pounds),	4,881.0	4,777.0	6,855.0	6,694.0	1,999.0	2,123.7
Per cent. of ash and clinker,	2.7	4.6	4.3	4.8	-	1.5
Duty based on total dry coal burned (foot-pounds),	93,761,973	95,867,476	91,104,390	92,458,975	92,025,790	87,420,358
Excess duty above guarantee (foot-pounds),	18,761,973	20,867,476	16,104,390	17,458,975	22,025,790	17,420,358
Bonus based on mean duty,	\$10,589 00		\$12,190 00		\$4,082 60	
Bonus paid (maximum allowed by contract),	8,000 00		10,000 00		3,000 00	

Results of Heat-unit Trials.

	PUMPING STATIONS.					
	DEER ISLAND.		EAST BOSTON.		CHARLESTOWN.	
	Engine No. 1.	Engine No. 2.	Engine No. 1.	Engine No. 2.	Engine No. 1.	Engine No. 2.
	Feb. 29, 1896.	March 4, 1896.	Feb. 8, 1896.	Feb. 12, 1896.	May 18, 1896.	May 15, 1896.
Date of trial,	10	10	10	10	10	10
Duration (hours),	42,395	41,703	47,414	48,028	41,330	41,021
Total revolutions of engine,	70.60	69.50	79.02	80.05	68.97	68.40
Average revolutions per minute of engine,	11.640	11.596	15.425	15.600	8.970	9.080
Average lift (feet),	73.980	72.700	72.280	72.348	38.000	38.495
Average discharge (cu. ft. per sec.),	50.3	51.0	48.7	51.5	56.0	57.0
Average temperature of water pumped (degrees F.),	62.7527	62.8325	63.0780	62.8810	62.9510	62.9500
Weight per cubic foot of water pumped (pounds),	21,931.85	21,049.25	28,818.75	29,605.20	10,207.00	10,179.60
Total water fed to boilers (pounds),	39.43	38.70	37.33	37.28	70.00	62.49
Average temperature of cold feed (degrees F.),	131.5	137.5	160.6	163.4	230.3	221.9
Average temperature of feed entering boilers (degrees F.),	114.30	119.30	115.23	114.37	113.50	114.00
Average pressure of steam (pounds per square inch),	-	-	22.3	22.6	14.5	15.4
Average pressure first receiver (pounds per square inch),	-	-	-2.10	-1.60	-4.60	-3.13
Average pressure second receiver (pounds per square inch),	-	-	13.8	14.2	13.6	13.0
Average pressure vacuum below atmosphere (pounds per square inch),	14.65	14.47	14.65	14.75	14.56	14.68
Barometer (pounds per square inch),	168.90	160.12	220.00	224.35	76.00	75.25
Indicated horse-power,	12.99	13.14	13.10	13.20	13.43	13.53
Feed-water per indicated horse-power per hour,						

WAKEFIELD BRANCH (SECTIONS 49 AND 50).

It is directed by chapter 414 of the Acts of 1896 of the Massachusetts Legislature that a branch of the Metropolitan Sewer be extended to Wakefield, to provide for parts of Melrose and the villages of Boyntonville and Greenwood in the town of Wakefield.

The act specifies that so much of the existing main sewer of Melrose is to be acquired, and paid for at its cost to the town, as extends from the Metropolitan main at the corner of Wyoming Avenue and Pleasant Street, through Wyoming Avenue, Berwick, Grove, Myrtle, Essex and Tremont streets to Lake Avenue, in said Melrose. This part of the Wakefield branch will be known as Section 49 of the North Metropolitan System.

The details relating to the sewer to be acquired appear in the following table : —

LOCATION.	SIZE.		Brick or Pipe.	Average Cut (Feet).
	Diameter (Inches).	Length (Feet).		
Wyoming Avenue,	20	29.24	Brick.	12.50
Wyoming Avenue,	24	16.58	Brick.	12.50
Private land of Boston & Maine Rail- road, Berwick and Grove streets, .	24	794.81	Pipe.	14.00
Myrtle, Essex and Tremont streets, .	18	2,704.25	Pipe.	17.00
Tremont Street to Lake Avenue, . .	15	343.16	Pipe.	18.00
Total length,		3,888.04		

Regulator and overflow at Wyoming Avenue, and 21 man-holes.

The records of the Board of Sewer Commissioners of the town of Melrose indicate that this length of sewer has cost the town \$19,455.03.

The act further specifies that a new sewer shall be constructed through Tremont, Melrose, Belmont, Franklin and Greenwood streets in Melrose to the Wakefield town line. This when constructed will be known as Section 50 of the North Metropolitan System. Early in the year detailed surveys and maps of this route were prepared. Twenty-three pipe soundings have been made to locate accurately the ledge on Greenwood Street, the deep bed of silt which requires piling on Tremont Street, and to ascertain other geological information along the route. The details of Section 50 as required to be constructed are outlined in the following table : —

LOCATION.	Character of Ex- cavation.	Size.		Brick or Pipe.	Average Cut (Feet).	Remarks.
		Diameter (Inches).	Length (Feet).			
Tremont Street,	Sand and gravel; 600 feet peat, .	18	1,000	Pipe.	7.80	7,000 feet piles.
Tremont Street to Franklin Street,	Sand and gravel; 300 feet peat, .	15	2,456	Pipe.	11.70	1,800 feet piles.
Franklin and Greenwood streets,	Sand and gravel; 900 feet rock, .	12	1,229	Pipe.	10.60	600 cubic yards rock.
Total length,			4,685			

The Engineer's estimate of cost for this work, including engineering and contingencies, is \$15,097.67.

The act authorizes an appropriation of \$30,000 to provide for the purchase of the town sewer and the cost of new construction. As outlined above, the sewer contemplated by the act will cost substantially \$5,000 more than the appropriation, and it is recommended that an additional appropriation of this amount be requested.

NEPONSET RIVER VALLEY SYSTEM.

Surveys and maps for an intercepting sewer in the Neponset valley from Central Avenue, Dorchester, to a point in Dedham about 100 feet north-west of the Dedham Branch of the New York, New Haven & Hartford Railroad, covering a distance of about 7 miles, had been prepared and the exact line of the sewer over the route determined as early as March 5, 1896. From this date until July 8, 1896, contracts for its construction were made, and after Aug. 1, 1896, construction was in progress on all the contract sections over the entire route. Approximately, 4 miles of the sewer have now been completed, and, at the present rate of progress, it is likely that the 7 miles above referred to will be in condition for service early in 1897.

It is believed that the present appropriation will cover the cost of the construction now in progress.

ROUTE OF THE SEWER.

The sewer as built above Central Avenue in Dorchester follows the northerly shore of the Neponset River, generally in private lands, to Mattapan Square; from Mattapan Square to Mattapan Mills, Hyde Park, in River Street; thence in private lands on the westerly shore of the river to Walnut Street, Hyde Park; thence through Walnut Street, Bleakie Mills property, crossing Hyde Park Avenue, through Factory Street, Barry Place, Business and River streets to near the mills of B. B. & R. Knight at the corner of West River Street; thence along the northerly and westerly shore of Mother Brook to Colburn Street in Dedham; through Colburn Street to Maverick Street, and thence along the northerly shore of Mother Brook to Curve Street, through Curve Street to East Street; thence in marsh lands along the Charles River to a point about 100 feet north-west of the Dedham Branch of the New York, New Haven & Hartford Railroad near the West Roxbury line.

SIZE OF THE SEWER.

From Central Avenue, Dorchester, to the Hyde Park line, the sewer is 3 feet in diameter for a distance of about 6,470 feet, and 2 feet 6 inches in diameter for a distance of about 1,708 feet, having at its end the full carrying capacity of the Dorchester Interceptor.

Above the Hyde Park line to a point about 50 feet south-east of Wood Avenue on River Street, a distance of about 2,676 feet, the sewer is 4 feet 6 inches in diameter; to the centre of Hyde Park Avenue at the junction of Factory Street, a distance of about 6,462 feet, 4 feet 3 inches in diameter; to about the junction of Maverick and Colburn streets, Dedham, a distance of about 13,263 feet, 4 feet in diameter; to about 100 feet north-westerly beyond the Dedham Branch of the New York, New Haven & Hartford Railroad, a distance of about 5,060 feet, 3 feet 9 inches in diameter.

It is expected that at a later period a large gravity sewer, known as "The High-level Sewer," with an outlet into the Boston Main Drainage System at Squantum or elsewhere, will intercept the Neponset Valley Sewer at or near the Hyde Park line at the lower end of the 4-foot 6-inch section. After that time the 3-foot sewer and the 2-foot 6-inch sewer through Dorchester to Central Avenue will serve permanently for certain low areas in Dorchester and Milton requiring their sewage to be pumped.

DAY WORK.

For 1,000 feet above Central Avenue the Neponset Interceptor is built through the mill yard and pond of the Tileston & Hollingsworth Company (Eagle Mills). The route is located largely in rock tunnel under and adjacent to tenement-houses, water-conduits and filters. To avoid possible complications with the mill owners during construction this part of the sewer has been built by day labor, and is known as Section 12.

TABLE OF DETAILS.

The remainder of the work is to be constructed by contract, and the details relating to the sections are briefly stated in the following table:—

Section	Location.	Diameters.	Approximate Length (Feet).	Date of Contract.	Contract awarded to —
12	In Dorchester, from the end of the Dorchester Intercepting Sewer built by the city of Boston to a point in the property of Abba M. Martine.	3'x3' 1", . . .	986	- - -	Day work.
13	From the end of Section 12 to a point in River Street, Dorchester, about 120 feet east of the centre line of Fremont Street	3'x3' 1", . . .	3,900	March 21, 1896,	H. P. Nawn, Roxbury, Mass.
14	From the end of Section 13 to a point in River Street, Dorchester, about 270 feet west of Oakland Street.	3'x3' 1", 2' 6" x 2' 7", . . .	1,028	March 21, 1896,	H. P. Nawn, Roxbury, Mass.
15	From the end of Section 14, Dorchester, to a point in River Street, Hyde Park, about 20 feet east of Wachusett Street.	2' 6" x 2' 7", 4' 6" x 4' 7", . . .	2,470	March 23, 1896,	H. P. Nawn, Roxbury, Mass.
16	From the end of Section 15 to a point in River Street, Hyde Park, about 620 feet west of Wood Avenue.	4' 6" x 4' 7", 4' 3" x 4' 4", . . .	2,374	March 23, 1896,	H. P. Nawn, Roxbury, Mass.
17	From the end of Section 16 to a point near the junction of Metropoli-	4' 3" x 4' 4", . . .	1,768	April 25, 1896,	George R. Newman & Co., Providence, R. I.
feet east of Atherton Street.					
21	From the end of Section 20, Hyde Park, to a point in Dedham about 1,000 feet west of the town line between Hyde Park and Dedham.	4'x4' 1", . . .	3,000	June 27, 1896,	Mathers & Sullivan, Washington, D. C.
22	From the end of Section 21 to a point about 550 feet north-west of Mill Lane.	4'x4' 1", . . .	2,400	June 27, 1896,	Mathers & Sullivan, Washington, D. C.
23	From the end of Section 22 to a point in Colburn Street about 40 feet south-east of Maverick Street.	4'x4' 1", . . .	2,000	July 1, 1896,	Haskin & Murphy, Charlestown, Mass.
24	From the end of Section 23 to a point in Curve Street about 430 feet east of Washington Street.	4'x4' 1", 3' 9" x 3' 10", . . .	2,470	July 8, 1896,	Haskin & Murphy, Charlestown, Mass.
25	From the end of Section 24 to a point about 100 feet north-west of the Dedham Branch of the New York, New Haven & Hartford Railroad.	3' 6" x 3' 10", . . .	3,670	July 8, 1896,	E. W. Everson, Providence, R. I.
Total length, Neponset Valley Intercepting Sewer, Sections 12 to 25, inclusive, 35,656 feet (6.75 + miles).					

EXTENSION OF THE SYSTEM THROUGH WEST ROXBURY TO NEAR THE BROOKLINE TOWN LINE.

During the year surveys have been made and detailed maps prepared for the remainder of the interceptor through West Roxbury, as contemplated in the act authorizing the construction. Two hundred and ninety pipe soundings have been made to determine the character of the excavation. The route as selected above Dedham follows generally at the edge of the marsh north and west of the Charles River to Gardner Street, West Roxbury; thence in Gardner Street to the crossing of the Brookline water mains; thence northerly, parallel with the taking of the Brookline Water Works, to Farragut Street; thence in private and marsh lands to Baker Street, through St. Joseph's Cemetery near the brook to La Grange Street; thence easterly along La Grange Street to a brook 250 feet east of Weld Street; thence in the valley of the brook northerly in private lands to Raymond Street near the Brookline town line.

Some additional facts relating to this portion of the sewer appear in the following table:—

LOCATION.	Character of Excavation.	SIZE.		Brick or Pipe.	Average Cut (Feet).
		Diameter (Inches).	Length (Feet).		
Private land,	Peat, sand and gravel, .	45	2,245	Brick.	16.60
Private land,	Peat, sand and gravel, .	34	4,580	Brick.	13.80
Private land, Gardner Street, private land,	Peat, sand and gravel, .	32	3,300	Brick.	11.00
Private land,	Peat, sand and gravel, .	26	2,108	Brick.	8.60
Private land and La Grange Street,	Sand and gravel, . . .	20	2,042	Pipe.	9.80
Private land,	Peat, sand and gravel, .	15	1,873	Pipe.	9.30
Private land, Brookline Water Works taking,* .	Peat, sand and gravel and ledge,	12	2,207	Pipe.	11.80
Total length,			18,655		

* Brookline Branch.

The Engineer's estimate for this construction, including land rights, engineering and contingencies, is \$180,000.

The act authorizing the construction of the Neponset Valley Sewer contemplated the purchase of Sections 9, 10 and 11 of the Dorchester Interceptor of the Boston Main Drainage System, ex-

tending from Central Avenue to Granite Bridge, to provide for connections from the town of Milton. The present cost of these sections to the city of Boston, together with an estimate for unadjusted rights of way, is \$106,265.68.

Frank I. Capen, Assistant Engineer, has had immediate charge of the day-work construction on Section 12.

Frederick D. Smith, Assistant Engineer, has had general charge of contract construction in the Neponset Valley.

Surveys and preparation of contract maps for the work have been in charge of Francis L. Sellew, Assistant Engineer.

C. Barton Pratt and Seth Peterson, assistant engineers, have had immediate charge of the sections outlined in the detailed report which follows.

W. G. Crispin, a member of the engineering force employed on surveys in the Neponset Valley, died of pneumonia at his home in Magnolia, Mass., Dec. 6, 1895. He had been connected with this office since July, 1893. He was always faithful and efficient in service and was highly esteemed by all members of the engineering department. This is the second death in the engineering force since its organization.

A detailed report relating to construction in the Neponset Valley follows : —

SECTION 12, NEPONSET VALLEY SYSTEM (DAY WORK), DORCHESTER.

Location. — From the end of the Dorchester Intercepting Sewer, built by the city of Boston, to Central Avenue, through Central Avenue and westerly through the property of the Tileston & Hollingsworth Company (Eagle Mills), across an arm of the mill pond and private land to a point in the property of Abba M. Martine.

Diameter and length of sewer : —

3 feet by 3 feet 1 inch, 986.50 feet.

Assistants.

Assistant Engineer : Frank I. Capen.

Foreman : Patrick McCarthy.

Transitmen : Principal — Wm. M. Stodder.

Assistant — F. W. Stockbridge.

Trench and Tunnel.

	3 Feet by 3 Feet 1 Inch Sewer.
Length of trench excavated to bottom of underdrain (feet),	587.00
Length of tunnel excavated to bottom of underdrain (feet),	320.00
Average depth of trench excavation to bottom of underdrain (feet),	16.00
Greatest depth of trench excavation to bottom of underdrain (feet),	18.00
Average width, top of trench (feet),	6.30
Average width, bottom of trench (feet),	6.10
Average depth from surface of ground to bottom of tunnel excavation (feet),	26.00
Greatest depth from surface of ground to bottom of tunnel excavation (feet),	30.00
Average width of tunnel excavation (feet),	5.00
Volume of trench excavation per linear foot (cubic yards),	4.00
Volume of tunnel excavation per linear foot (cubic yards),	1.00
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$8.35.	
Approximate cost of tunnel excavation per linear foot, including excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$14.	

Character of Excavation. — For the first 212 feet the excavation was in gravel and sand with some rock in the bottom of the trench. This was followed by about 320 feet of rock tunnel. Following this for about 250 feet across the mill pond there were 7 feet of filling, 2 feet of mud, and gravel to grade. For the remainder of the distance the excavation was in loam, filling and gravel.

Diameters of underdrain laid and length of each size : —	
4-inch,	280 feet.
8-inch,	348 “

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.60.
Approximate cost of masonry per linear foot of tunnel, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$4.77.

Length of masonry completed (trench),	573 feet.
Length of masonry completed (tunnel),	60 “

Masonry was begun in trench May 2, 1896, and is now in progress (Sept. 30, 1896).
Masonry was begun in tunnel Sept. 23, 1896, and is now in progress (Sept. 30, 1896).
Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$20.48.

Excavation. — An open-cut excavation was started at the end of the Dorchester Intercepting Sewer in Central Avenue on April 9, 1896, and extended southerly for 212 feet. In the yard of the Tileston & Hollingsworth Company a tunnel shaft near Station 3+0 was commenced on April 15, 1896, and a tunnel extended backward about 100 feet and forward about 150 feet. On June 11, 1896, an open-cut excavation was started at the upper end of the section in the Martine estate, which was worked backward 362

feet, about 250 feet of this distance being across an arm of the Eagle Mills pond. At the end of this section crossing the pond a tunnel heading was started Aug. 25, 1896, which was worked northerly toward the first-named shaft at Station 3+0, that had been started April 15. This tunnel is still unfinished. At the shafts a siphon ejector raised the ground-water. At the open-cut excavation started on April 9, 1896, at the beginning of the section, but a slight amount of ground-water was encountered, and this was drained for a short time into the Dorchester Interceptor in Central Avenue. At the open-cut excavation at the end of the section the water in the trench was handled by contractor's pump on Section 13.

Foundation. — The foundation has been either of clay and gravel, or rock, except under the mill pond, where coarse gravel was found.

Difficulties. — Crossing the mill pond an embankment was built with its surface about 1 foot above high-water mark. It was about 8 feet wide on top with natural slopes. After the embankment had settled a trench was excavated in it. Two-inch matched sheeting was used. No special difficulty was found in crossing the pond in this manner. The water was drained through an 8-inch pipe.

On the tunnel work the close proximity to buildings, cisterns and filters of the Eagle Mills made it necessary to exercise great caution in blasting. Very light charges of explosive only could be used. The rock was exceedingly hard, requiring the loading of many of the holes more than once, the consequence being a very slow rate of progress.

Miscellaneous. — After the sewer across the mill pond was constructed, the embankment was graded with surplus earth to an elevation about 3 feet above the ordinary surface of the pond. As completed the embankment is 8 feet wide at the top with slopes, $1\frac{1}{2}$ to 1, paved with riprap of surplus rock from the tunnel excavation.

An opening 25 feet in width has been left, midway of the embankment, for the passage of boats. Here the arch of the sewer is reinforced with 8-inch granite blocks anchored into the concrete masonry of the invert. The water at this opening is about 3 feet deep over the sewer arch.

SECTION 13 (NEPONSET VALLEY SYSTEM), DORCHESTER.

Location. — From a point in private land, on the southerly bank of the Neponset River, about 1,000 feet west of Central Avenue, extending westerly in proposed streets through private land of John Conness and Thomas Liversidge estate to River Street, a distance of about 2,900 feet; thence in River Street to about 120 feet east of the centre line of Fremont Street; a total distance of 3,800 feet.

Diameter and length of sewer:—
3 feet by 3 feet 1 inch, 3,800 feet.

Contractor. — Harry P. Nawn of Roxbury, Mass. Mr. Nawn has acted as his own superintendent.

Contractor's Principal Foremen. — John Ellwood, Patrick Foley, Frank Riley.

*State Assistants.**

- Assistant Engineer: C. Barton Pratt.
- Inspectors: Caleb Kimball, S. B. Horton, Charles Roesbeck, Chris Rasmussen, John Craib.
- Transitmen: Principal — Charles H. Smith, Charles Kincaid, G. E. Stratton, Henry Cleary.
- Assistant — M. F. Sanborn, Leon Alland, Mark E. Taylor, Walter Cleary.

Trench and Tunnel.

	3 Feet by 3 Feet 1 Inch Sewer.
Length of trench excavated to bottom of underdrain (feet),	3,408.00
Length of tunnel excavated to bottom of underdrain (feet),	260.00
Average depth of trench excavation to bottom of concrete (feet),	11.80
Greatest depth of trench excavation to bottom of concrete (feet),	20.90
Average width, top of trench (feet),	5.50
Average width, bottom of trench (feet),	5.40
Average depth from surface of ground to bottom of tunnel concrete (feet),	18.60
Greatest depth from surface of ground to bottom of tunnel concrete (feet),	26.80
Average width of tunnel excavation (feet),	5.70
Volume of trench excavation per linear foot (cubic yards),	2.40
Volume of tunnel excavation per linear foot (cubic yards),	1.30

Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$3.79.

Approximate cost of tunnel excavation per linear foot to date (Sept. 30, 1896), \$7.

Character of Excavation. — For 180 feet from beginning of section, 1 foot loam, sand, gravel and boulders to grade; then for 250 feet, 1 foot loam, then sand and gravel to ledge, averaging about 5 feet deep in the bottom; then for 318 feet, 1 foot loam with sand and gravel to grade; then for 82 feet, a rock tunnel. From a point about 962 feet from the beginning of the section, tunnel through sand, gravel and boulders for 178 feet; from this point the trench begins again with 1 foot loam, 6 feet sand and gravel, then fine sand to grade, extending for 500 feet, changing here to loam, sand and gravel for 1,500 feet, at which point the excavation was through 1½ feet road-bed, then sand and gravel with a bottom of ledge for 220 feet, changing again to road-bed, then sand, clay and gravel for 440 feet to the end of the section.

* The above-named State assistants have been employed for part of the time only on Section 13.

Masonry.

Contract prices : —

Brickwork, American cement mortar, per cubic yard (trench), . . .	\$12 50
Brickwork, American cement mortar, per cubic yard (tunnel), . . .	15 00
Brickwork, Portland cement mortar, per cubic yard (trench), . . .	14 00
Brickwork, Portland cement mortar, per cubic yard (tunnel), . . .	16 00
Concrete, American cement mortar, per cubic yard (trench), . . .	5 00
Concrete, American cement mortar, per cubic yard (tunnel), . . .	7 00

Diameters of underdrain laid and length of each size : —

6-inch,	471 feet.
8-inch,	2,896 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$4.11.

Length of masonry completed (trench), 3,331 feet.

Masonry begun in trench April 16, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$8.29.*

* To Sept. 30, 1896, no masonry has been built in tunnel on Section 13.

Excavation.

	Opening No. 1.	Opening No. 2.	Opening No. 3.	Opening No. 4.	Opening No. 5.	Opening No. 6.
Character of opening,	Open cut,	Tunnel,	Open cut,	Tunnel,	Open cut,	Open cut.
Number of tunnel headings,	- - - -	One,	- - - -	One,	- - - -	- - - -
Date of starting,	April 6, 1896,	July 8, 1896,	May 13, 1896,	July 8, 1896,	May 14, 1896,	July 1, 1896.
Point of beginning,	Beginning of section.	748 feet from beginning of section.	1,623 feet from beginning of section.	1,140 feet from beginning of section.	1,623 feet from beginning of section.	In River Street, 2,940 feet from beginning of section.
Point of ending or where work was in progress Sept. 30, 1896,	748 feet from beginning of section.	836 feet from beginning of section.	1,140 feet from beginning of section.	986 feet from beginning of section.	In River Street, 2,940 feet from beginning of section.	In River Street, 3,800 feet from beginning of section.
Date of finishing. . . .	July 8, 1896,	In progress Sept. 30, 1896.	July 6, 1896,	In progress Sept. 30, 1896.	July 27, 1896,	Sept. 3, 1896.
Length,	748 feet,	88 feet,	483 feet,	154 feet,	1,317 feet,	860 feet.
Ordinary progress per week,	70 feet,	9 feet,	60 feet,	16 feet,	130 feet,	90 feet.
Appliances used,	Hand labor,	Wheelbarrows,	Hand labor,	Wheelbarrows,	Hand labor,	Hand labor.
Size of gang ordinarily employed,	30 men,	8 men,	25 men,	8 men,	30 men,	27 men.

The ground-water was handled by two 6-inch centrifugal pumps, one at the beginning of the section and one at a point 1,623 feet from the beginning. At the first-named point the greatest rate of pumping was about 200,000 gallons in 24 hours; at the second point, about 300,000 gallons.

Foundation. — For considerable portions of this section the soil in the bottom of the trench has been loose sand and gravel, this formation being of such a nature that it could not safely be shaped to fit the invert of the sewer. A foundation of American concrete has been generally used. In ledge the sewer has been laid with an American concrete invert 6 inches in thickness on the bottom and 8 inches on the sides at the springing line. A 4-inch brick invert has been laid in the concrete. The arch of the sewer throughout the section has been 8 inches in thickness.

Surplus Material. — The surplus earth has been used for filling low areas of land within the Liversidge estate, adjacent to the line of the sewer. A road leading to the rear of the institution on this estate has been partially graded with surplus rock from the section.

SECTION 14 (NEPONSET VALLEY SYSTEM), DORCHESTER.

Location. — From a point in River Street, about 120 feet east of the centre line of Fremont Street, extending south-westerly in River Street, through private and railroad lands, and through Mattapan Square and River Street to a point about 270 feet west of Oakland Street.

Diameters of sewers and length of each size: —

3 feet by 3 feet 1 inch,	1,689 00 feet.
2 feet 6 inches by 2 feet 7 inches,	239.53 "

Contractor. — Harry P. Nawn of Roxbury, Mass. Mr. Nawn has acted as his own superintendent.

Contractor's Principal Foremen. — J. B. Cummerford, Frank Riley.

*State Assistants.**

Assistant Engineer: C. Barton Pratt.

Inspectors: H. M. Woodward, H. E. Tatro, Charles Roesbeck, S. B. Horton.

Transitmen: Principal — C. H. Smith, Henry Cleary, Charles Kincaid, G. E. Stratton.

Assistant — Leon Alland, M. F. Sanborn, Mark E. Taylor.

* The above-named State assistants have been employed for part of the time only on Section 14.

Trench.

	3 Feet by 3 Feet 1 Inch Sewer.		2 Feet 6 Inches by 2 Feet 7 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet),	520	1,169	239.50
Average depth of trench excavation to bottom of concrete (feet),	5.40	15.00	14.30
Greatest depth of trench excavation to bottom of concrete (feet),	8.00	21.30	18.00
Average width, top of trench (feet),	6.20	5.60	5.70
Average width, bottom of trench (feet),	6.00	6.20	4.80
Volume of trench excavation per linear foot (cubic yards),	1.20	3.30	2.80
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896),	\$2 71	\$6 44	\$2 40

Character of Excavation.— For the first 75 feet, filling, sand, gravel and clay to grade; then for the next 465 feet, about 3 feet of mud, then sand, gravel and clay to grade, changing to sand, gravel and boulders with wet sandy clay to grade for a distance of 288 feet; here the excavation changes to sand, gravel and boulders under which ledge was found for a distance of 832 feet, merging into 2 feet filling, 1 foot loam, sand, clay and gravel to grade for a distance of 268 feet to end of section.

Masonry.

Contract prices:—

Brickwork, American cement mortar, per cubic yard (trench),	\$12 50
Brickwork, Portland cement mortar, per cubic yard (trench),	14 00
Concrete, American cement mortar, per cubic yard (trench),	5 00
Concrete, Portland cement mortar, per cubic yard (trench),	7 00

Diameters of underdrain laid and length of each size:—

6-inch,	1,012 5 feet.
8-inch,	916.0 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.22.

Length of masonry completed (trench), 1,928.5 feet.

Masonry begun in trench April 13, 1896; finished Sept. 30, 1896.

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$10.49.

Excavation.

	Opening No. 1.	Opening No. 2.	Opening No. 3.
Character of opening,	Open cut,	Open cut,	Open cut.
Date of starting,	April 6, 1896,	July 13, 1896,	July 31, 1896.
Point of beginning,	In private way just beyond Burt estate, about 586 feet from beginning of section.	About 250 feet south-west of south-west-erly side of Mattapan Square.	In private way just beyond Burt estate, about 586 feet from beginning of section.
Point of ending,	Mattapan Square,	Mattapan Square,	In River Street, about 120 feet east of the centre line of Fremont Street.
Date of finishing,	Sept. 17, 1896,	Sept. 24, 1896,	Aug. 28, 1896.
Length,	1,062 feet,	280.5 feet,	586 feet.
Ordinary progress per week,	48 feet,	30 feet,	146 feet.
Appliances used,	By hand labor and steam derrick.	Hand labor,	Hand labor.
Size of gang ordinarily employed,	31 men,	16 men,	26 men.

The ground-water was taken care of as follows: for 280 feet, at the end of the section, the water was removed by a pulsometer located in a well used jointly for sections 14 and 15; a second pump-well was located about 586 feet from the beginning of Section 14, where the water was removed by hand-pumps.

Foundation. — Through the private way, about 720 feet from the beginning of the section, the bottom of the trench was excavated to fit the invert of the sewer for a distance of about 53 feet, where the soil was hard, sandy clay and fine gravel.

Through the private way, 586 feet from the beginning of the section, for a distance of 137 feet, it was found necessary to excavate to a depth of 2 feet below the water line of the sewer and refill with gravel, as the original soil for this length consisted of wet, sandy clay.

The soil in the bottom of the trench, other than as heretofore stated, consisted of sand, gravel and clay, and rock. Where this formation was encountered the sewer was built with concrete invert about 6 inches in depth on the bottom and 8 inches in thickness on the sides, together with 4-inch brick invert and arch of 8-inch brick masonry.

Difficulties. — Near its lower end this section passes through a flowed area, adjacent to the Neponset River, sometimes covered with one or two feet of water. The excavation was through 2½ feet of mud, followed by sand and gravel to grade. Dikes of the excavated material excluded the river from the trench, and the water then entering it was readily controlled by hand-pumps.

For 520 feet in this locality the crown of the sewer arch is about 2 feet below the surface of the ground. Here the sewer was built with a reinforced section. A 4-inch invert and an 8-inch arch, both of Portland brick masonry, were built in a Portland concrete invert. The sewer was back-filled with Portland concrete to a depth of about 8 inches over the crown of the arch, in which curved sheets of expanded metal were placed. The sheets were 4 feet wide by 6 feet long, of No. 16 gauge and 4-inch mesh. They were held in place in the concrete by 8-inch channel irons 3 feet long, and securely anchored into the invert masonry by bolts 4 feet 6 inches long and of ¾-inch diameter.

Surplus Material. — The surplus earth has been used for filling low lands adjacent to the line of the sewer.

SECTION 15 (NEPONSET VALLEY SYSTEM), DORCHESTER AND HYDE PARK.

Location. — From a point in River Street, Dorchester, about 270 feet west of Oakland Street, extending westerly through River Street to a point in Hyde Park about 20 feet east of Wachusett Street.

Diameters of sewers and length of each size : —
2 feet 6 inches by 2 feet 7 inches, 1,464.00 feet.
4 feet 6 inches by 4 feet 7 inches, 1,006.30 “

Contractor. — Harry P. Nawn of Roxbury, Mass. Mr. Nawn has acted as his own superintendent.

Contractor's Principal Foremen. — Robert Eager, William Hall.

State Assistants.*

Assistant Engineer : C. Barton Pratt.
Inspectors : Michael Garra, C. G. Waite, John Craib.
Transitmen : Principal — Charles H. Smith, Henry Cleary, G. E. Stratton, Charles Kincaid.
Assistant — M. F. Sanborn, Leon Alland, Mark E. Taylor.

Trench and Tunnel.

	2 Feet 6 Inches by 2 Feet 7 Inches Sewer.	4 Feet 6 Inches by 4 Feet 7 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet),	1,464.00	507.00
Length of tunnel excavated to bottom of underdrain (feet),	—	429.30
Average depth of trench excavation to bottom of concrete (feet),	15.60	18.90
Greatest depth of trench excavation to bottom of concrete (feet),	17.40	19.20
Average width, top of trench (feet),	5.50	8.60
Average width, bottom of trench (feet),	5.00	6.70
Average depth from surface of ground to bottom of tunnel concrete (feet),	—	24.90
Greatest depth from surface of ground to bottom of tunnel concrete (feet),	—	27.40
Average width of tunnel excavation (feet),	—	7.00
Volume of trench excavation per linear foot (cubic yards),	3.00	5.40
Volume of tunnel excavation per linear foot (cubic yards),	—	2.00
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896),	\$5 45	\$6 98
Approximate cost of tunnel excavation per linear foot, including excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896),	—	12 00

Character of Excavation. — For the first 60 feet, 2 feet street surfacing, clay, sand and gravel to grade; for the next 180 feet, 2 feet street surfacing, 4 feet sand, sand, clay and gravel, with ledge in the bottom; then for 272 feet, 2 feet surfacing,

* The above named State assistants have been employed for part of the time only on Section 15.

4 feet sand, then sand, gravel and boulders to grade; for the next 356 feet, street surfacing, 2 feet sand, gravel and boulders on top of ledge varying from 1 to 9 feet in depth; then for the next 738 feet, 1 foot street surfacing, 1 foot loam, sand, gravel, clay and boulders to grade; for the next 174 feet, 1 foot filling, 2 feet sandy loam and gravel, 7 feet sand and gravel, then sand, gravel, clay and boulders, with ledge in the bottom; then for 191 feet, street filling, 1 foot sandy loam, 6 feet coarse sand, then sand, gravel, clay and boulders, with ledge in the bottom. The 429.30 feet of tunnel on this section was excavated through ledge.

Masonry.

Contract prices:—

Brickwork, American cement mortar, per cubic yard (trench),	.	.	\$12 50
Brickwork, American cement mortar, per cubic yard (tunnel),	.	.	15 00
Brickwork, Portland cement mortar, per cubic yard (trench),	.	.	14 00
Brickwork, Portland cement mortar, per cubic yard (tunnel),	.	.	16 00
Concrete, American cement mortar, per cubic yard (trench),	.	.	5 00
Concrete, American cement mortar, per cubic yard (tunnel),	.	.	6 00
Concrete, Portland cement mortar, per cubic yard (trench),	.	.	7 00
Concrete, Portland cement mortar, per cubic yard (tunnel),	.	.	8 00

Diameters of underdrain laid and length of each size:—

6-inch,	. . . . .	1,006 feet.
8-inch,	. . . . .	790 "
10-inch,	. . . . .	64 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$4.65.

Length of masonry completed (trench), 1,560 feet.

Masonry begun in trench April 21, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$11.74.*

Excavation.

	Opening No. 1.	Opening No. 2.	Opening No. 3.
Character of opening,	Open cut, . . .	Tunnel, . . .	Tunnel.
Number of tunnel headings, . . .	- -	One, . . .	Two.
Date of starting, . . .	April 6, 1896, . .	April 25, 1896, . .	July 28, 1896.
Point of beginning, . . .	Lower end of section.	In River Street about 20 feet east of Wachusett Street.	About 80 feet westerly from Holmfield Ave.
Point where work was in progress Sept. 30, 1896, . . .	1,971 feet from beginning of section.	273.3 feet east of Wachusett Street.	About opposite the centre line of Holmfield Avenue and about 176 feet west of Holmfield Avenue.
Length,	1,971 feet, . . .	253.3 feet, . . .	176 feet.
Ordinary progress per week,	73 feet,	12 feet,	24 feet.
Appliances used, . . .	Carson trench machine.	Steam derrick, . . .	Steam derrick.
Size of gang ordinarily employed,	36 men,	6 men,	12 men.

* To Sept. 30, 1896, no masonry has been built in tunnel on Section 16.

The ground-water was raised by two 4-inch pulsometer pumps and one 6-inch centrifugal pump. A well was located about 60 feet from the beginning of the section, where one of the pulsometers handled the water for the lower 1,100 feet of the section. A second well was located about 1,100 feet from the beginning of the section, where the second pulsometer took care of the water for the next 300 feet. At this point a spring was encountered in the bottom of the trench, necessitating a third well and the use of a 6-inch centrifugal pump to the end of the section. In addition, hand-pumps were occasionally used.

Foundation. — Near the beginning of the section, for a distance of 449 feet, the bottom of the trench has been excavated to fit the invert of the sewer in a formation of clay, sand and gravel. For the balance of the section the bottom of the trench was of sand, gravel, boulders or ledge, necessitating the building of an invert of American concrete 6 inches in depth on the bottom and 6 inches in thickness on the sides. The brick invert of the sewer was then laid with Portland cement mortar. The flooding of the trench by a spring, above noted, about 1,450 feet from the beginning of the section, near the Hyde Park line, was the only special difficulty of the section. Up to Sept. 30, 1896, the maximum pumpage at this point is estimated at 800,000 gallons per 24 hours.

SECTION 16 (NEPONSET VALLEY SYSTEM), HYDE PARK.

Location. — From a point in River Street, Hyde Park, about 20 feet east of Wachusett Street, extending south-westerly through River Street across the New England Railroad and railroad property; thence into River Street, about opposite Radcliffe Road, extending through River Street to a point about 620 feet west of Wood Avenue.

Diameters of sewers and length of each size : —

4 feet 6 inches by 4 feet 7 inches,	. . . . .	1,690 feet.
4 feet 2 inches by 4 feet 3 inches,	. . . . .	684 "

Contractor. — Harry P. Nawn of Roxbury, Mass. Mr. Nawn has acted as his own superintendent.

Contractor's Principal Foremen. — William Hall, Peter Mally.

*State Assistants.**

Assistant Engineer : C. Barton Pratt.

Inspector : Michael Garra.

Transitmen : Principal — Henry Cleary, Charles H. Smith, Charles Kincaid, G. E. Stratton.

Assistant — Leon Alland, M. F. Sanborn, Mark E. Taylor.

* The above-named State assistants have been employed for part of the time only on Section 16.

Trench and Tunnel.

	4 Feet 6 Inches by 4 Feet 7 Inches Sewer.	4 Feet 2 Inches by 4 Feet 8 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet),	490.00	98.00
Length of tunnel excavated to bottom of underdrain (feet),	885.00	-
Average depth of trench excavation to bottom of concrete (feet),	26.40	20.50
Greatest depth of trench excavation to bottom of concrete (feet),	27.60	20.80
Average width, top of trench (feet),	9.00	8.60
Average width, bottom of trench (feet),	7.10	6.60
Average depth from surface of ground to bottom of tunnel concrete (feet),	27.90	-
Greatest depth from surface of ground to bottom of tunnel concrete (feet),	34.40	-
Average width of tunnel excavation (feet),	7.20	-
Volume of trench excavation per linear foot (cubic yards),	7.90	5.80
Volume of tunnel excavation per linear foot (cubic yards),	1.80	-
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896),	\$16 05	\$6 00
Approximate cost of tunnel excavation per linear foot, including excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896),	18 90	-

Character of Excavation.— From a point at the beginning of the section in River Street, about 20 feet east of Wachusett Street, the excavation was by tunnel, through ledge, for a distance of 207 feet; then open cut through sand and gravel on top of ledge from 1 to 27 feet in depth for a distance of 280 feet; then open cut with sand, gravel and boulders for 65 feet; then tunnel for 96 feet with sand, gravel and boulders; then open cut for 145 feet through 1 foot loam, 8 feet sand and gravel; then fine sand to grade. Tunnel, 82 feet with sand, gravel and boulders. At a point in River Street about opposite the south-westerly side of Wood Avenue, and for a distance of 98 feet, 2 feet of street surfacing, then sand, gravel and small boulders to grade.

Masonry.

Contract prices :—

Brickwork, American cement mortar, per cubic yard,	\$12 50
Brickwork, Portland cement mortar, per cubic yard,	14 00
Concrete, American cement mortar, per cubic yard,	5 00
Concrete, Portland cement mortar, per cubic yard,	7 00

Diameters of underdrain laid and length of each size :—

6-inch,	545 feet.
8-inch,	397 "

Approximate cost of masonry per linear foot of trench and tunnel, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$8.94.

Length of masonry completed (trench),	371 feet.
Length of masonry completed (tunnel),	96 "

Masonry begun in trench May 30, 1896, and is now in progress (Sept. 30, 1896).

Masonry begun in tunnel June 23, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$14.35.

Excavation.

	Opening No. 1.	Opening No. 2.	Opening No. 3.	Opening No. 4.	Opening No. 5.	Opening No. 6.
Character of opening,	Tunnel, . . .	Open cut, . . .	Tunnel, . . .	Open cut, . . .	Tunnel, . . .	Open cut.
Number of tunnel headings,	One, . . .	-	Two, . . .	-	One, . . .	-
Date of starting, . . .	April 6, 1896, . . .	May 14, 1896, . . .	April 10, 1896, . . .	June 29, 1896, . . .	Aug. 3, 1896, . . .	Sept. 3, 1896.
Point of beginning, . . .	At the beginning of the section, about 20 feet east of Wachusetts Street.	About 85 feet east of the easterly side of New England Railroad tracks in railroad property.	85 feet east of easterly side of New England Railroad tracks in railroad property.	11 feet west of westerly side of New England Railroad tracks in railroad property.	Southerly line of River Street, 192 feet west of westerly side of New England Railroad tracks.	In River Street, opposite westerly side of Wood Avenue.
Point of ending or where work was in progress Sept. 30, 1896, . . .	In River Street, about 227 feet east of Wachusetts Street.	In River Street, about 227 feet east of Wachusetts Street.	11 feet west of westerly side of New England Railroad tracks in railroad property.	On south line of River Street, 192 feet west of west side of railroad track.	In River Street, 80 feet west of westerly line of Radcliffe Road.	In progress Sept. 30, 1896, at a point 98 feet westerly from Radcliffe Road in River Street.
Date of finishing, . . .	Sept. 21, 1896, . . .	Sept. 30, 1896, . . .	Aug. 21, 1896, . . .	Aug. 3, 1896, . . .	Aug. 27, 1896, . . .	In progress Sept. 30, 1896.
Length, . . .	207 feet, . . .	345 feet, . . .	96 feet, . . .	145 feet, . . .	82 feet, . . .	98 feet.
Ordinary progress per week, . . .	12 feet, . . .	18 feet, . . .	8 feet, . . .	36 feet, . . .	17 feet, . . .	29 feet.
Appliances used, . . .	Stiff-leg derrick with engine.	Double stiff-leg derrick with one engine.	Derrick and engine, . . .	Derrick and engine, . . .	Derrick and engine, . . .	Carson Trench Machine.
Size of gang ordinarily employed, . . .	7 men, . . .	16 men, . . .	7 men, . . .	14 men, . . .	7 men, . . .	14 men.

The ground-water was first removed by a 3-inch siphon ejector used at the shaft near the beginning of the section; later, a 6-inch Knowles pump was used here. Then a well was made at the side of the shaft near the railroad, and a No. 3 pulsometer pump removed the water from the tunnels and open cuts beyond.

Foundation. — An invert of 4-inch Portland brick masonry has been laid in a bed of American concrete, 6 inches in depth on the bottom and from 6 to 8 inches in thickness at the springing line, for the whole section.

Difficulties. — No special difficulties have been encountered on this section. The arch of the sewer in tunnel under the New England Railroad tracks, near the River-street station, Hyde Park, has been back-filled with American concrete. In open cut at both ends of tunnel under railroad, near River-street station, passing the slope of the highway embankment, the arch of the sewer has been reinforced by concrete spandrels.

Surplus Material. — The surplus material from the excavations has been used in filling land adjacent to the line of the sewer.

SECTION 17 (NEPONSET VALLEY SYSTEM), HYDE PARK.

Location. — From a point in River Street, Hyde Park, near Mattapan Mills, about 620 feet west of Wood Avenue, extending through River Street and private lands, along the Neponset River to a point near the junction of Metropolitan Avenue and Pierce Street.

Diameter and length of sewer: —

4 feet 3 inches by 4 feet 4 inches, 1,767.80 feet.

Contractors. — George R. Newman & Co. of Providence, R. I.

Contractors' Superintendent. — Charles L. Mowry.

Contractors' Principal Foreman. — Frank Brundage.

*State Assistants.**

Assistant Engineer: C. Barton Pratt.

Inspectors: B. L. Sykes, John D. Collins.

Transitmen: Principal — Henry Cleary, G. E. Stratton, Charles Kincaid, Charles H. Smith.

Assistant — Leon Alland, M. F. Sanborn, Mark E. Taylor.

* The above-named State assistants have been employed for a part of the time only on Section 17.

Trench and Tunnel.

	4 Feet 3 Inches by 4 Feet 4 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet), . . .	926.00
Length of tunnel excavated to bottom of underdrain (feet), . . .	172.00
Average depth of trench excavation to bottom of concrete (feet), . . .	16.00
Greatest depth of trench excavation to bottom of concrete (feet), . . .	31.30
Average width, top of trench (feet),	7.60
Average width, bottom of trench (feet),	7.20
Average depth from surface of ground to bottom of tunnel concrete (feet),	30.40
Greatest depth from surface of ground to bottom of tunnel concrete (feet),	32.60
Average width of tunnel excavation (feet),	5.30
Volume of trench excavation per linear foot (cubic yards),	4.40
Volume of tunnel excavation per linear foot (cubic yards),	1.50
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$11.59.	
Approximate cost of tunnel excavation per linear foot, including excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$12.75.	

Character of Excavation.—The 172 feet of tunnel in River Street was through very hard ledge. The open cut, which began in proposed street in Sumner estate, about 75 feet south of south side of River Street, was excavated through about 1½ feet loam, then sand and gravel, with ledge, to grade. The ledge was very irregular, varying from 1 to 19 feet in depth.

Masonry.

Contract prices :—	
Brickwork, American cement mortar, per cubic yard (trench), . . .	\$12 50
Brickwork, American cement mortar, per cubic yard (tunnel), . . .	13 85
Brickwork, Portland cement mortar, per cubic yard (trench), . . .	14 00
Brickwork, Portland cement mortar, per cubic yard (tunnel), . . .	15 65
Concrete, American cement mortar, per cubic yard (trench), . . .	5 00
Concrete, American cement mortar, per cubic yard (tunnel), . . .	5 85
Concrete, Portland cement mortar, per cubic yard (trench), . . .	6 75
Concrete, Portland cement mortar, per cubic yard (tunnel), . . .	7 50
Diameters of underdrain laid and length of each size :—	
6-inch,	263 feet.
8-inch,	590 "
Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.73.	
Length of masonry completed (trench),	802 feet.
Masonry begun in trench June 29, 1896, and is now in progress (Sept. 30, 1896).	
Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$18.45.*	

* To Sept. 30, 1896, no masonry has been built in tunnel on Section 17.

Excavation.

	Opening No. 1.	Opening No. 2.
Character of opening,	Open cut,	Tunnel.
Number of tunnel headings, . .	-	Two.
Date of starting,	May 14, 1896,	May 19, 1896.
Point of beginning,	In proposed street in Sumner estate, 75 feet south of southerly side of River Street.	In River Street, opposite easterly line of Sumner estate.
Point where work was in progress Sept. 30, 1896,	Near Neponset River, in estate of Caroline E. Mowry.	About 86 feet each way from shaft.
Length,	926 feet,	172 feet.
Ordinary progress per week, . .	50 feet,	14 feet.
Appliances used,	Stiff-leg derrick, engine and Brown Trench Machine.	Stiff-leg derrick and engine.
Size of gang ordinarily employed,	45 men,	15 men.

The ground-water was removed on the Sumner estate by a No. 5 pulsometer pump. At a well near the river, at the westerly line of the Field estate, a 4-inch centrifugal pump has been used, and at times a No. 5 pulsometer.

Foundation.—A 4-inch brick invert has been laid in a bed of American concrete, 6 inches in depth at the bottom and 6 to 8 inches in thickness at the springing line, for the whole section.

Surplus Material.—The surplus material from the excavations has been used in filling land adjacent to the line of the sewer.

SECTION 18 (NEPONSET VALLEY SYSTEM), HYDE PARK.

Location.—From near the junction of Metropolitan Avenue and Pierce Street, Hyde Park, south-westerly through private and railroad lands, through Station Street to a point in Walnut Street about 400 feet south-west of Fairmount Avenue.

Diameter and length of sewer:—

4 feet 3 inches by 4 feet 4 inches, 2,720 feet.

Contractors.—Troy Public Works Company of Troy, New York.

Contractors' Superintendent.—The work was superintended by Mr. M. McDonough, a member of the above-named corporation.

Contractors' Principal Foremen.—John McKenzie, James J. Cook, John Tohey, Walter Ferguson, John Jefferson.

*State Assistants.**

Assistant Engineer: Seth Peterson.

Inspectors: Caleb Kimball, J. E. Savage, A. C. Page.

Transitmen: Principal (in charge of lines and grades)—S. G. Packard.

Principal (in charge of records)—T. T. Cass, J. L. Lee, Jr.

Assistant—B. A. Loveland, H. L. Morrow, Eugene Russ, L. D. Hatch, Harry Kincaid.

* The above-named State assistants have been employed for part of the time only on Section 18.

Trench and Tunnel.

	4 Feet 3 Inches by 4 Feet 4 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet),	2,630.00
Length of tunnel excavated to bottom of underdrain (feet),	48.00
Average depth of trench excavation to bottom of underdrain (feet), . .	16.50
Greatest depth of trench excavation to bottom of underdrain (feet), . .	24.00
Average width, top of trench (feet),	7.70
Average width, bottom of trench (feet),	6.70
Average depth from surface of ground to bottom of tunnel underdrain (feet),	23.00
Greatest depth from surface of ground to bottom of tunnel underdrain (feet),	23.00
Average width of tunnel excavation (feet),	8.20
Volume of trench excavation per linear foot (cubic yards),	4.80
Volume of tunnel excavation per linear foot (cubic yards),	2.50
Approximate cost per linear foot, including sheeting left in, excava- tion and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$6.40.	

Character of Excavation.— At the beginning of the section the formation consisted of 2 feet peat, then sand, gravel and boulders to grade. Ledge was encountered in the bottom about 20 feet from the beginning. Four hundred and fifty feet from the beginning, 1 foot sand, 2 feet gravel, 1 foot peat, 3 feet gravel, ledge to grade. The ledge ran out near the foot of West Street. From West Street for the next 600 feet, 2 feet peat, then sand, gravel and clay to grade; next 150 feet, 2 feet peat, 2 feet clay, fine wet sand to grade; at foot of Walter Street, 2 feet peat, 3 feet sand and gravel, fine wet sand to grade; opposite New England Railroad station, 8 inches gravel, 3 feet sand, 5 feet loamy gravel, 2 feet clay, 1 foot peat, yellow sandy clay to grade; Station Street, 200 feet south of Fairmount Avenue, 1 foot surfacing, 8 feet filling (sand and gravel), 3 feet peat, 6 feet sand and clay, running sand below.

Masonry.

Contract prices :—	
Brickwork, American cement mortar, per cubic yard,	\$12 50
Brickwork, Portland cement mortar, per cubic yard,	14 50
Concrete, American cement mortar, per cubic yard,	5 50
Concrete, Portland cement mortar, per cubic yard,	7 00
Diameters of underdrain laid and length of each size :—	
6-inch,	500 feet.
8-inch,	1,140 "
10-inch,	874 "
Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$7.75.	
Length of masonry completed (trench),	2,456 feet.
Masonry was begun in trench May 22, 1896, and is now in progress (Sept. 30, 1896).	
Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$14.65.	

Excavation.

	Opening No. 1.	Opening No. 2.	Opening No. 3.	Opening No. 4.
Character of opening,	Open cut,	Open cut,	Open cut,	Open cut and tunnel.
Number of tunnel headings,	-	-	-	One.
Date of starting,	May 11, 1896,	May 11, 1896,	May 25, 1896,	Aug. 31, 1896.
Point of beginning,	At the beginning of the section near junction of Metropolitan Avenue and Pierce Street.	At foot of West Street,	About 600 feet north of New England Railroad station.	At the end of the section.
Point of ending, or where work was in progress Sept. 30, 1896,	At foot of West Street,	About 600 feet north of New England Railroad station.	At easterly side of New England Railroad tracks, 200 feet south of Fairmount Avenue.	93 feet back from end of section.
Date of finishing,	Aug. 3, 1896,	Aug. 26, 1896,	In progress Sept. 30, 1896,	In progress Sept. 30, 1896.
Length,	500 feet,	924 feet,	1,156 feet,	93 feet.
Ordinary progress per week,	40 feet,	70 feet,	90 feet,	25 feet.
Appliances used,	Hand labor,	Hand labor,	Carson Trench Machine,	Derrick and wheelbarrows.
Size of gang ordinarily employed,	20 men,	25 men,	30 men,	10 men.

The ground-water was taken care of by a 4-inch centrifugal pump near the beginning of the section, a 6-inch centrifugal pump at the foot of West Street and a 6-inch centrifugal pump near the beginning of Opening No. 3. The 4-inch pump and the first-mentioned 6-inch pump were afterwards used at points about 900 feet north of the New England Railroad station. As there was very little water at the beginning of the section, no measurements were taken. Estimated maximum rate of pumping per 24 hours, when the three pumps were working together, 1,000,000 gallons.

Foundation. — A very fine sand mixed with wet clay, which gave considerable trouble for a time, was encountered about 1,000 feet north of the New England Railroad station, and extended for a length of about 200 feet.

For a length of 260 feet, between the New England Railroad station and the coal sheds of S. B. Balkam & Co., nearly opposite Walter Street, it was found necessary to excavate to a depth of 6 to 8 inches below the bottom of the masonry and refill with gravel, the soil removed consisting of fine sand mixed with a small amount of clay.

The soil in the bottom of the trench has been generally sand and gravel, occasionally mixed with clay. An American concrete invert has been built through the greater portion of the section.

Difficulties. — Passing under the railroad, heavy stringers, 40 feet in length, were placed under each rail during the construction. All masonry within the railroad taking was of Portland cement, 6 inches of Portland concrete being placed over the arch in addition to the usual section.

Miscellaneous. — The sewer line at the crossing of the New England Railroad tracks, near the coal sheds of S. B. Balkam & Co., was moved southerly about 5 feet to get further from the bridge abutment. A slight change in the line was also made in Station Street, south of Fairmount Avenue, to avoid the pipes in that street.

Surplus Material. — Within the railroad yard surplus earth has been levelled over the sewer trench.

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SECTION 19, HYDE PARK.

VIEW IN WALNUT ST., JULY 30, 1896.

SECTION 19 (NEPONSET VALLEY SYSTEM), HYDE PARK.

Location.— From a point in Walnut Street, Hyde Park, about 400 feet south-west of Fairmount Avenue, extending south-westerly through Walnut Street and private lands, under New York, New Haven & Hartford Railroad, to Business Street and to a point in Business Street about 625 feet south-west of Barry Place.

Diameters of sewers and length of each size :—

4 feet 3 inches by 4 feet 4 inches,	. . . . .	1,287 feet
4 feet by 4 feet 1 inch,	. . . . .	1,355 "

Contractors.— George S. Good & Co. of Lock Haven, Pa.
Contractors' Superintendent.— F. C. Hitchcock.
Contractors' Principal Foreman.— Thomas Ferguson.

State Assistants.*

Assistant Engineer : Seth Peterson.
Inspectors : A. C. Page, John Craib, J. E. Savage.
Transitmen : Principal (in charge of lines and grades) — S. G. Packard.
Principal (in charge of records) — T. T. Cass, J. L. Lee, Jr.
Assistant — H. L. Morrow, B. A. Loveland, Eugene Russ, Harry Kincaid.

Trench.

	4 Feet 3 Inches by 4 Feet 4 Inches Sewer.	4 Feet by 4 Feet 1 Inch Sewer.
Length of trench excavated to bottom of underdrain (feet),	1,050.00	89.00
Average depth of trench excavation to bottom of underdrain (feet),	19.30	16.50
Greatest depth of trench excavation to bottom of underdrain (feet),	25.00	17.00
Average width, top of trench (feet),	8.50	6.30
Average width, bottom of trench (feet),	6.00	6.30
Volume of trench excavation per linear foot (cubic yards),	5.00	4.00
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896),	\$4 90	\$3 60

Character of Excavation.— Beginning of section, 1 foot street surfacing, sand, gravel and clay to a depth of about 18 feet; then mixture of clay and sand to grade. At Bridge Street, 1 foot surfacing, 4 feet gravel and sand, ledge to grade. Opposite corner Bleakie's Mill, 1 foot loam, 6 feet loam and gravel, 5 feet hard clay and gravel, hard pan below. Barry Place, 1 foot surfacing, 6 feet gravel, 3 feet fine sand, sand and gravel below.

* The above-named State assistants have been employed for part of the time only on Section 19.

Masonry.

Contract prices : —

Brickwork, American cement mortar, per cubic yard,	. . . .	\$12 00
Brickwork, Portland cement mortar, per cubic yard,	. . . .	14 00
Concrete, American cement mortar, per cubic yard, .	. . . .	6 00
Concrete, Portland cement mortar, per cubic yard, .	. . . .	7 50

Diameters of underdrain laid and length of each size : —

6-inch,	212 feet.
8-inch,	813 “

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.90.

Length of masonry completed, 971 feet.

Masonry was begun in trench June 12, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$10.35.

Excavation.

	Opening No. 1.	Opening No. 2.
Character of opening,	Open cut,	Open cut.
Date of starting,	May 18, 1896,	Sept. 16, 1896.
Point of beginning,	Beginning of section, .	Barry Place, just west of New York, New Haven & Hartford Railroad.
Point where work was in progress Sept. 30, 1896,	In Bleakie's Mill yard, 150 feet ahead of Walnut Place.	In Barry Place, 100 feet from railroad tracks.
Length,	1,050 feet,	80 feet.
Ordinary progress per week, .	60 feet,	30 feet.
Appliances used,	Carson Trench Machine, .	Steam derrick.
Size of gang ordinarily employed,	30 men,	15 men.

The ground-water was taken care of at the beginning of the section by a 4-inch pulsometer; at the railroad tracks a 2-inch pump was used. At the beginning of the section the maximum rate of pumping in 24 hours was 35,000 gallons.

Foundation. — The bottom of the trench has been shaped to fit the invert of the sewer for several short lengths near the beginning of the section, making a total length of about 182 feet, in a formation of clay with gravel.

It was found necessary to excavate 4 inches below the bottom of the masonry for several short lengths on Walnut Street, aggregating 128 feet, and to refill with gravel. The earth removed was soft clay and sand.

At all points other than described above, the formation has con-

sisted of a mixture of clay and sand and about 268 feet of rock. This clay and sand was shaped as nearly as possible to fit the invert of the sewer, the uneven places being then filled with concrete.

Accident. — On Aug. 22, 1896, Thomas Murray, employed as water-boy, fell into the trench and broke his arm. He has recovered and is employed on the work again.

Miscellaneous. — From Barry Street to the end of the section the line has been moved easterly, in order to avoid pipes and to give additional room in the street for teams.

Surplus Material. — The surplus material has been used in filling low lands adjacent to the line of the sewer.

SECTION 20 (NEPONSET VALLEY SYSTEM), HYDE PARK.

Location. — From a point in Business Street, Hyde Park, about 625 feet south-west of Barry Street, extending south-westerly through Business and West River streets to a point about 25 feet east of Atherton Street.

Diameter and length of sewer:—

4 feet by 4 feet 1 inch, 3,228 feet.

Contractors. — George S. Good & Co. of Lock Haven, Pa.

Contractors' Superintendent. — F. C. Hitchcock.

Contractors' Principal Foreman. — H. H. De Grofft.

State Assistants.*

Assistant Engineer: Seth Peterson.

Inspector: Geo. A. Chase.

Transitmen: Principal (in charge of lines and grades) — S. G. Packard.

Principal (in charge of records) — T. T. Cass, J. L. Lee, Jr.

Assistant — B. A. Loveland, H. L. Morrow, Eugene Russ, Harry Kincaid.

Trench.

	4 Feet by 4 Feet 1 Inch Sewer.
Length of trench excavated to bottom of underdrain (feet),	1,645.00
Average depth of trench excavation to bottom of underdrain (feet),	15.80
Greatest depth of trench excavation to bottom of underdrain (feet),	19.30
Average width, top of trench (feet),	7.30
Average width, bottom of trench (feet),	6.60
Volume of trench excavation per linear foot (cubic yards),	4.50
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$3.70.	

Character of Excavation. — At the beginning of the opening, 250 feet from beginning of section, 8 inches street surfacing, 8 feet sand and gravel, then sand and gravel with considerable clay to grade. At a point 100 feet from Business Street on River Street, 1 foot surfacing, 7 feet sand and gravel, fine sand below. At Ellis Street, 1 foot surfacing, 8 feet sand and gravel, then sand and clay to grade. Two hundred feet south of Church Street, 1 foot surfacing, 6 feet gravel, 1 foot sand and clay, then hard pan to grade.

* The above-named State assistants, except Mr. George A. Chase, have been employed for part of the time only on Section 20.

Masonry.

Contract prices : —

Brickwork, American cement mortar, per cubic yard,	\$12 00
Brickwork, Portland cement mortar, per cubic yard,	14 00
Concrete, American cement mortar, per cubic yard,	6 00
Concrete, Portland cement mortar, per cubic yard,	7 50

Diameters of underdrain laid and length of each size : —

6-inch,	374 feet.
10-inch,	1,195 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.95.

Length of masonry completed, 1,511 feet.

Masonry was begun in trench June 19, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$9.95.

Excavation.

Character of opening,	Open cut.
Date of starting,	May 22, 1896.
Point of beginning,	250 feet from the beginning of the section.
Point where work was in progress Sept. 30, 1896,	200 feet south-west of Church Street.
Length,	1,645 feet.
Ordinary progress per week,	100 feet.
Appliances used,	Carson Trench Machine.
Size of gang ordinarily employed,	37 men.

The ground-water was removed by two 6-inch centrifugal pumps, one near the beginning of the section, at the corner of Glenwood Avenue and Business Street, and another on River Street, between Ellis and Church streets. The two pumps were in operation together for a few days only. The estimated maximum rate of pumping was 750,000 gallons in 24 hours.

Foundation. — A fine sand heavily charged with water was encountered from about opposite the Boston Blower Company's factory to the corner of River Street. This caused some delay in sinking a well at the corner of Glenwood Avenue. It was found necessary to excavate to a depth of 4 to 6 inches below grade and refill with gravel from a point 200 feet north-east of Glenwood Avenue to River Street, and in River Street for 170 feet between Business and Ellis streets, the earth removed being fine, wet sand.

For the whole section a concrete invert has been built.

Miscellaneous. — To avoid pipes and give more room for traffic, the sewer line has been moved from that shown on contract maps to westerly side of River Street.

Surplus Material. — The surplus material has been used for filling low land adjacent to the line of the sewer.

SECTION 21 (NEPONSET VALLEY SYSTEM), HYDE PARK AND DEDHAM.

Location.—From a point in River Street, Hyde Park, about 25 feet east of Atherton Street, extending westerly through public and private lands along the northerly bank of Mother Brook to a point in Dedham about 1,000 feet west of the town line between Hyde Park and Dedham.

Diameter and length of sewer:—

4 feet by 4 feet 1 inch, 3,600 feet.

Contractors.—Mathers & Sullivan of Washington, D. C. The work was superintended by members of this firm.

Contractors' Principal Foreman.—Richard Morrissey.

State Assistants.*

Assistant Engineer: Seth Peterson.

Inspector: Chris Rasmussen.

Transitmen: Principal (in charge of lines and grades) — J. L. Brown.

Principal (in charge of records) — Geo. F. Chase.

Assistant—A. B. Cleaveland, F. W. Crispin, L. D. Hatch, H. E. Tatro.

Trench.

	4 Feet by 4 Feet 1 inch Sewer.
Length of trench excavated to bottom of underdrain (feet),	1,979.00
Average depth of trench excavation to bottom of underdrain (feet),	12.00
Greatest depth of trench excavation to bottom of underdrain (feet),	18.50
Average width, top of trench (feet),	6 70
Average width, bottom of trench (feet),	6.50
Volume of trench excavation per linear foot (cubic yards),	2.90

Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$3.55.

Character of Excavation.—From the beginning of the work for a distance of about 300 feet, 1½ feet loam, 2 feet sand and gravel, fine, wet sand below; for the next 1,100 feet, 1 foot loam, sand and gravel below; for the next 300 feet, ledge starts from about water line and runs to within a foot of surface, then drops back to grade; sand and gravel above ledge; beyond ledge, about 1 foot of loam, fine sand to grade.

Masonry.

Contract prices:—

Brickwork, American cement mortar, per cubic yard,	\$10 35
Brickwork, Portland cement mortar, per cubic yard,	11 50
Concrete, American cement mortar, per cubic yard,	5 75
Concrete, Portland cement mortar, per cubic yard,	6 75

Diameters of underdrain laid and length of each size:—

8-inch,	30 feet.
10-inch,	1,740 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.40.

* The above-named State assistants, except Mr. Chris Rasmussen, have been employed for a part of the time only on Section 21.

Length of masonry completed (trench), 1,480 feet.

Masonry begun in trench July 27, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$9.65.

Excavation.

Character of opening,	Open cut.
Date of starting,	July 7, 1896.
Point of beginning,	About 150 feet from beginning of section.
Point where work was in progress Sept. 30, 1896,	About the middle of Fairview Cemetery.
Length,	1,979 feet.
Ordinary progress per week,	200 feet.
Appliances used,	Hand labor.
Size of gang ordinarily employed,	85 men.

The ground-water was removed by a 6-inch centrifugal pump, which was located near the beginning of the section. A 6-inch Worthington pump was also used in the trench for a short time. The estimated maximum rate of pumping in 24 hours was 1,000,000 gallons.

Foundation. — A fine, wet sand was encountered for the first 300 feet of the section. This sand was removed to a depth of 8 inches below the masonry and replaced with gravel. At several other points in similar excavation 4 to 8 inches have been excavated below grade and replaced with gravel. On all other portions of the section the excavation at the bottom of the trench has consisted of sand and gravel.

A concrete invert has been used throughout the section.

Difficulties. — Some trouble occurred in sinking one of the pump-wells, due to fine sand; no special difficulty has been encountered on this section.

Surplus Material. — Considerable gravel from the excavation has been screened and used in concrete. Much of the surplus material has been spread within the lines of taking.

SECTION 22 (NEPONSET VALLEY SYSTEM), DEDHAM.

Location. — From a point in Dedham about 1,000 feet west of the town line between Dedham and Hyde Park, extending in a north-westerly direction along the bank of Mother Brook, to a point about 550 feet north-west of Mill Lane.

Diameter and length of sewer: —
4 feet by 4 feet 1 inch, 2,400 feet.

Contractors. — Mathers & Sullivan of Washington, D. C. The work was superintended by members of this firm.

Contractors' Principal Foremen. — C. Broughton, D. A. Walker.

*State Assistants.**

Assistant Engineer: Seth Peterson.

Inspector: H. M. Woodward.

Transitmen: Principal (in charge of lines and grades) — J. L. Brown.

Principal (in charge of records) — Geo. F. Chase.

Assistant — L. D. Hatch, A. B. Cleaveland, F. W. Crispin, H. E. Tatro.

Trench.

	4 Feet by 4 Feet 1 Inch Sewer.
Length of trench excavated to bottom of underdrain (feet), . . .	920.00
Average depth of trench excavation to bottom of underdrain (feet), .	16.00
Greatest depth of trench excavation to bottom of underdrain (feet), .	24.00
Average width, top of trench (feet),	10.60
Average width, bottom of trench (feet),	6.50
Volume of trench excavation per linear foot (cubic yards), . . .	5 00
Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$10.	

Character of Excavation. — From a point about 80 feet east of the Norfolk Mills dam, for a distance of about 155 feet, 1 foot loam, then sand, gravel and boulders to grade. The remainder of the excavation was through a similar formation with ledge in the bottom, running from water line of sewer to 15 feet above.

Masonry.

Contract prices: —

Brickwork, American cement mortar, per cubic yard,	\$10 35
Brickwork, Portland cement mortar, per cubic yard,	11 50
Concrete, American cement mortar, per cubic yard,	5 75
Concrete, Portland cement mortar, per cubic yard,	6 75

Diameters of underdrain laid and length of each size: —

6-inch,	268 feet.
8-inch,	178 "
4-inch,	80 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.85.

Length of masonry completed (trench), 492 feet.

Masonry was begun in trench Aug. 6, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$16.25.

Excavation.

Character of opening,	Open cut.
Date of starting,	July 13, 1896.
Point of beginning,	At Norfolk Mills dam.
Point where work was in progress Sept. 30, 1896,	400 feet west of Norfolk Mills dam and 500 feet east of same.
Length,	920 feet.
Ordinary progress per week,	90 feet.
Appliances used,	Rock removed from excavation by derrick; other material thrown out by hand.
Size of gang ordinarily employed,	90 men.

* The above named State assistants have been employed for part of the time only on Section 22.

The ground-water has been removed by two 2-inch Worthington pumps and a 6-inch Worthington pump. Maximum pumpage, 400,000 gallons in 24 hours.

Foundation. — None of the excavation has been shaped to fit the invert of the sewer. For 200 feet east of Norfolk Mills dam the excavation has been in sand and gravel mixed with clay. The bottom of the excavation for the remainder of the section has been of rock.

A concrete invert has been used throughout the section.

Difficulties. — Passing the Norfolk Mills dam, a concrete cut-off wall was carried up to the core-wall of the dam, and, for 10 feet on either side, the trench has been filled with Portland concrete to the crown of the sewer arch. To check the flow of water along the trench, concrete cut-off walls were built 30 feet either side of the dam.

Miscellaneous. — The sewer line was slightly changed above the dam to avoid valuable trees.

SECTION 23 (NERONSET VALLEY SYSTEM), DEDHAM.

Location. — From a point on the northerly bank of Mother Brook, 550 feet north-west of Mill Lane, extending north-westerly through public and private lands along Mother Brook to a point in Colburn Street about 40 feet south-easterly of Maverick Street.

Diameter and length of sewer:—

4 feet by 4 feet 1 inch, 2,600 feet.

Contractors. — Haskin & Murphy of Charlestown, Mass.

Contractors' Superintendent. — Thomas H. Murphy, a member of the above-mentioned firm.

Contractors' Principal Foremen. — Martin McLauthlin, Henry Burke.

State Assistants.*

Assistant Engineer: Seth Peterson.

Inspector: Geo. F. Greenlaw.

Transitmen: Principal (in charge of lines and grades) — J. L. Brown.

Principal (in charge of records) -- Geo. F. Chase.

Assistant — H. E. Tatro, L. D. Hatch, A.B. Cleaveland, F.W. Crispin.

Tunnel.

	4 Feet by 4 Feet 1 Inch Sewer.
Length of tunnel excavated to bottom of underdrain (feet),	676.00
Average depth from surface of ground to bottom of tunnel underdrain (feet),	24.00
Greatest depth from surface of ground to bottom of tunnel underdrain (feet),	28.50
Average width of tunnel excavation (feet),	5.80
Volume of tunnel excavation per linear foot (cubic yards),	1.60
Approximate cost of tunnel excavation per linear foot, \$10.†	

Character of Excavation. — All rock (tunnel).

* The above-named State assistants have been employed for part of the time only on Section 23.

† Contractors' bid. No masonry or underdrain has been laid to date.

Masonry.

Contract prices :—

Brickwork, American cement mortar, per cubic yard (trench),	. .	\$12 00
Brickwork, American cement mortar, per cubic yard (tunnel),	. .	14 00
Brickwork, Portland cement mortar, per cubic yard (trench),	. .	13 00
Brickwork, Portland cement mortar, per cubic yard (tunnel),	. .	15 00
Concrete, American cement mortar, per cubic yard (trench),	. . .	5 00
Concrete, American cement mortar, per cubic yard (tunnel),	. . .	6 00
Concrete, Portland cement mortar, per cubic yard (trench),	. . .	7 50
Concrete, Portland cement mortar, per cubic yard (tunnel),	. . .	8 50

Excavation.

	Opening No. 1.	Opening No. 2.
Character of opening, . . .	Tunnel,	Tunnel.
Number of tunnel headings, .	Two,	Two.
Date of starting,	July 20, 1896,	July 13, 1896.
Point of beginning,	About 175 feet from corner of Maverick and Colburn streets.	About 400 feet from corner of Maverick and Colburn streets.
Point where work was in progress Sept. 30, 1896, . . .	134 feet toward Maverick Street from shaft; 150 feet north of shaft.	168 feet from shaft toward Maverick Street and 224 feet in opposite direction.
Length,	284 feet,	392 feet.
Ordinary progress per week, .	30 feet,	40 feet.
Appliances used,	Drills run by compressed air; elevators at shaft; wheelbarrows.	Same appliances as in Opening No. 1.
Size of gang ordinarily employed,	21 men,	17 men.

The ground-water has been removed by a 2-inch steam pump at each shaft. The estimated maximum pumpage was 5,000 gallons per 24 hours.

Accident. — Henry Ryder, a laborer on the work, lost the sight of one eye, it having been struck by a flying chip of rock.

Surplus Material. — The surplus rock has been crushed; some of it has been sold and the remainder stored for use in the concrete masonry for the tunnel.

SECTION 24 (NEPONSET VALLEY SYSTEM), DEDHAM.

Location. — From a point in Colburn Street, about 40 feet south-east of Maverick Street, extending north-westerly through private land along the north-erly bank of Mother Brook to Curve Street.

Diameters of sewers and length of each size :—

4 feet by 4 feet 1 inch,	. . . . .	80 feet.
3 feet 9 inches by 3 feet 10 inches,	. . . . .	2,390 "

Contractors. — Haskin & Murphy of Charlestown, Mass.
Contractors' Superintendent. — Thomas H. Murphy, a member of the above-men-tioned firm.
Contractors' Principal Foremen. — Tunnel: Martin McLaughlin, Henry Burke; Open cut: John McLaughlin.

State Assistants.*

Assistant Engineer : Seth Peterson.
Inspector : George F. Greenlaw.
Transitmen : Principal (in charge of lines and grades) — George S. Miller.
Principal (in charge of records) — Geo. F. Chase.
Assistant — J. T. P. Jones, R. W. Greenlaw, Eugene Russ.

Trench and Tunnel.

	8 Feet 9 Inches by 3 Feet 10 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet), . . .	70.00
Length of tunnel excavated to bottom of underdrain (feet), . . .	562.00
Average depth of trench excavation to bottom of underdrain (feet), .	17.50
Greatest depth of trench excavation to bottom of underdrain (feet), .	17.50
Average width, top of trench (feet),	6.70
Average width, bottom of trench (feet),	6.40
Average depth from surface of ground to bottom of tunnel underdrain (feet),	20.00
Greatest depth from surface of ground to bottom of tunnel underdrain (feet),	23.00
Average width of tunnel excavation (feet),	5 80
Volume of trench excavation per linear foot (cubic yards), . . .	4.25
Volume of tunnel excavation per linear foot (cubic yards), . . .	1.60
Approximate cost of excavation per linear foot, \$15.40. .	

Character of Excavation. — Tunnel, all rock. Open cut, about 2 feet loam, 6 feet gravelly clay and boulders, ledge below.

Masonry.†

Contract prices : —	
Brickwork, American cement mortar, per cubic yard,	\$12 50
Brickwork, Portland cement mortar, per cubic yard,	14 00
Concrete, American cement mortar, per cubic yard,	5 50
Concrete, Portland cement mortar, per cubic yard,	6 90

* The above-named State assistants have been employed for a part of the time only on Section 24.
† No masonry or underdrain has been laid to date.

Excavation.

	Opening No. 1.	Opening No. 2.	Opening No. 3.
Character of opening,	Tunnel,	Tunnel,	Open cut.
Number of tunnel headings,	Two,	Two,	-
Date of starting,	July 13, 1896,	July 20, 1896,	Aug. 3, 1896.
Point of beginning,	About 200 feet west of corner of Maverick and Colburn streets.	About 600 feet west of corner of Colburn and Maverick streets.	About 1,250 feet west of corner of Colburn and Maverick streets.
Point where work was in progress Sept. 30, 1896,	125 feet toward Maverick Street, 132 feet opposite direction.	160 feet toward Maverick Street, 155 feet opposite direction.	About 100 feet toward Maverick Street.
Length,	287 feet,	315 feet,	70 feet.
Ordinary progress per week,	30 feet,	35 feet,	20 feet.
Appliances used,	Elevators and cars to take material out of tunnel; drills run by compressed air.	Same as in Opening No. 1,	Travelling derrick.
Size of gang ordinarily employed,	17 men,	17 men,	30 men.

The ground-water has been removed by a 2-inch steam pump at shaft No. 1, a No. 5 pulsometer pump at shaft No. 2, and a 6-inch centrifugal pump at the open cut. The maximum rate of pumping has been 10,000 gallons in 24 hours.

Surplus Material. — Much of the surplus rock has been levelled near the shafts and stored along the excavated trench; some has been crushed and sold or used in concrete masonry.

SECTION 25 (NEPONSET VALLEY SYSTEM), DEDHAM.

Location. — From a point in Curve Street, about 430 feet east of Washington Street, extending north-westerly through public and private land to a point about 100 feet north-west of the Dedham Branch of the New York, New Haven & Hartford Railroad.

Diameter and length of sewer: —

3 feet 9 inches by 3 feet 10 inches, 2,670 feet.

Contractor. — E. W. Everson of Providence, R. I.

Contractor's Superintendent and Foreman. — Geo. W. Upper.

State Assistants.*

Assistant Engineer: Seth Peterson.

Inspectors: Geo. F. Greenlaw, Charles Roesbeck.

Transitmen: Principal (in charge of lines and grades) — Geo. S. Miller.

Principal (in charge of records) — Geo. F. Chase.

Assistant — J. T. P. Jones, R. W. Greenlaw, Eugene Russ.

Trench.

	3 Feet 9 Inches by 3 Feet 10 Inches Sewer.
Length of trench excavated to bottom of underdrain (feet), . .	650.00
Average depth of trench excavation to bottom of underdrain (feet), .	22.50
Greatest depth of trench excavation to bottom of underdrain (feet), .	23.00
Average width, top of trench (feet), . \	8.00
Average width, bottom of trench (feet),	6.00
Volume of trench excavation per linear foot (cubic yards), . . .	6.00

Approximate cost of trench per linear foot, including sheeting left in, excavation and refilling below masonry, back-filling, etc., to date (Sept. 30, 1896), \$7.30.

Character of Excavation. — At beginning of section, 8 inches gravel street surfacing, 2½ feet loam, gravel and sand below; 40 feet east of Washington Street, 8 inches surfacing, 2½ feet loam, sand and fine gravel to grade; 200 feet west of Washington Street, 8 inches surfacing, 2½ feet loam, gravel and sand to arch, fine, wet sand to grade.

* The above-named State assistants have been employed for a part of the time only on Section 25.

SECTION 25. DEOHAM.

VIEW IN CURVE ST. JULY 30. 1894

Masonry.

Contract prices : —

Brickwork, American cement mortar, per cubic yard,	\$12 00
Brickwork, Portland cement mortar, per cubic yard,	13 50
Concrete, American cement mortar, per cubic yard,	5 00
Concrete, Portland cement mortar, per cubic yard,	7 00

Diameters of underdrain laid and length of each size : —

10-inch,	428 feet.
12-inch,	197 "

Approximate cost of masonry per linear foot of trench, including underdrain, tarred paper, etc., to date (Sept. 30, 1896), \$5.30.

Length of masonry completed (trench), 560 feet.

Masonry was begun in trench Aug. 22, 1896, and is now in progress (Sept. 30, 1896).

Approximate cost of section per linear foot of excavation and masonry, including labor, material, inspection and miscellaneous items, to date (Sept. 30, 1896), \$13.

Excavation.

Character of opening,	Open out.
Date of starting,	July 27, 1896.
Point of beginning,	At beginning of section.
Point where work was in progress Sept. 30, 1896,	Curve Street, about 50 feet east of Centre Street.
Length,	650 feet.
Ordinary progress per week,	150 feet.
Appliances used,	Brown excavator.
Size of gang ordinarily employed,	50 men.

The ground-water has been removed by an 8-inch centrifugal pump near the beginning of the section. A pulsometer was also used at the end of the excavated trench. The maximum pumpage has been 1,200,000 gallons in 24 hours.

Foundation. — None of the bottom excavation has been shaped to fit the invert of the sewer. For a length of about 100 feet near Washington Street the trench has been excavated below masonry to a depth of 12 inches and refilled with gravel in a formation of fine, wet sand. The bottom excavation, except as above described, has been in sand, gravel and ledge.

An American concrete invert has been used throughout the section.

Miscellaneous. — The sewer line has been moved toward the south side of the street from the beginning of the section to Centre Street, to afford more room for travel during the construction of the sewer.

Surplus Material. — Surplus material has been used as filling on lands adjacent to the line of the sewer.

CEMENT TESTING.

Approximately 12,000 barrels of cement have been tested during the year, 4,000 barrels of Portland and 8,000 barrels of American. Four thousand tests have been made.

The cement used has been of the best English and American brands. The cement has been tested for fineness, strength, setting qualities, and for checking and cracking.

TABLE OF PROGRESS.

The following table recapitulates to some extent the detailed information given in the foregoing pages and in reports of preceding years. The Charles River Valley sections are designated by letters and those of the North Metropolitan and Neponset Valley areas by numbers.

Where work on the same section has continued through two or more years some statistics and other statements contained in former reports have been repeated for convenience of reference. This is desirable, among other reasons, on account of the great scarcity of some of the earlier reports.

The foregoing detailed reports of sections are in general condensed from those of the various assistant engineers directly connected with the work.

TABLE OF SEWER WORK COMPLETED AND IN PROGRESS SEPT. 30, 1896.

Section.	LOCALITY.	NAME OF CONTRACTOR.	Total Length of Section, Feet.	SIZE OF SEWER.	Average Depth of Trench, Bottom of Underdrain or Deeper Excavation, Feet.	Length of Sewer completed Sept. 30, 1896, Feet.	Date of Completion named in Contract.
A	Boston,	H. O. Eyre,	3,701	5' 6",	20.3	3,701	Aug. 31, 1891
B	Boston and Brookline,	H. O. Eyre,	2,902	5' 6",	18.5	2,902	Feb. 28, 1891
C	Brighton,	National Construction Co.,	5,787	4' 10",	16.4	5,787	Aug. 31, 1891
D	Brighton,	National Construction Co.,	5,300	4' 10" X 5' 3",	17.2	5,300	July 31, 1891
E	Brighton,	Jones & Meehan,	8,027	4' 6" X 5' 1",	14.7	8,027	Nov. 30, 1891
F	Newton and Watertown,	Jones & Meehan,	1,875	4' 3" X 4' 9", 3' 11" X 4' 5",	10.4	7,675	Nov. 30, 1891
G	Newton,	Jones & Meehan,	2,800	3' 11" X 4' 6", 3' 6" X 4',	19.1	2,800	Nov. 30, 1891
H	Newton,	Metropolitan Construction Co.,	4,497	3' 6" X 4',	13.7	4,497	Nov. 30, 1891
I	Deer Island,	Day work,	1,931	6' 3",	14	1,931	-
J	Deer Island,	National Construction Co.,	2,120	Outfall sewer, 6' X 6' to 6' X 10', Main sewer, 9',	17 } 23 }	2,120	Feb. 29, 1892
K	Deer Island,	R. A. Malone & Co.,	2,641	9',	26	2,641	April 30, 1891
L	Deer Island and Winthrop,	Day work,	480	Main sewers, 9', 6' 4", Sand-catcher, 16' X 10', Siphon, 6' 2",	21 } 23 } 18 }	135 } 23 } 204 }	-
M	Winthrop,	Metropolitan Construction Co.,	5,710	9',	22	5,710	June 30, 1891

TABLE OF SEWER WORK COMPLETED, ETC. — Continued.

Section.	Locality.	NAME OF CONTRACTOR.	Total Length of Section, Feet.	SIZE OF SEWER.	Average Depth of Trench, Bottom of Underdrain or Deepen Excavation, Feet.	Length of Sewer completed Sept. 30, 1896, Feet.	Date of Completion named in Contract.
7	Winthrop and East Boston, . . .	Trumbull & Ryan, . . .	848	{ Main sewer, 8' 6" X 9' 2" Sand catcher, 16' X 16' 6", and siphon ap- proaches, . . . Siphon (3 parallel lines), 5', . . . }	{ 6.5 11.4 13.6 }	848	June 1, 1893
8	Breed's Island, . . .	Charles Linahan, . . .	4,126	9', . . .	16.4	4,126	Aug. 31, 1897
14	Chelsea, . . .	Metropolitan Construction Co., . . .	3,445	8' 10", 8' 4" X 9', 8' 2" X 8' 10", . . .	{ 28.60" 37.0' }	3,445	Dec. 30, 1893

No.	Location	Work	Contractor	Length ft.	Depth ft.	Area sq. ft.	Volume cu. ft.	Date
19	Everett and Medford,	Day work,		406				1893
20	Medford,	John Bheehan,		9,170				April 30, 1893
21	Medford,	National Construction Co.,		8,030				Feb. 28, 1893
22	Medford (Gravelly Brook culvert),	Sub-contractors: Wm. H. Lenox & Co., A. W. Byrne,		54				54
23	Medford (Winthrop Street culvert),	Day work,		181				181
24	West Medford,	Andrew W. Byrne,		6,033				June 30, 1893
25	Everett,	R. A. Malone & Sons,		2,308				June 30, 1892
26	Everett and Charlestown,	Metropolitan Construction Co.,		2,332				Sept. 30, 1892
27	Charlestown,	Day work,		1,540				1,540
28	Charlestown,	Day work,		505				505
29	Barnstable,	Day work,		950				950
30	Barnstable and Cambridge,	McGovern & Kitch, Metropolitan Construction Co.,		4,326				Aug. 31, 1893
31	Cambridge,	John L. Beardon & Co.,		6,503				April 30, 1894

* Trench.

† Tunneled.

‡ Part of.

TABLE OF SEWER WORK COMPLETED, ETC. — Continued.

Section.	LOCALITY.	NAME OF CONTRACTOR.	Total Length of Section, Feet.	SIZE OF SEWER.	Average Depth of Trench, Bottom of Deeper Excavation, Feet.	Length of Sewer completed Sept. 30, 1893. Feet.	Date of Completion named in Contract.
29	Cambridge,	Lindsay & Cudmore,	5,157	{ 4'x4' 6", 3' 8" x 4' 2", 3' 6" x 4",	{ 16.2 } 12.9 } 18.0 }	5,157	Nov. 30, 1893
30	Cambridge,	Jones & Meehan,	7,032	{ 3' 5" x 3' 8", 2' 10" x 3', 2' 8" x 2' 10", 2' 3" x 2' 4",	{ 13.8 } 15.6 } 12.7 }	7,032	April 30, 1894
31	Charlestown,	Metropolitan Construction Co.,	4,509	{ 2' 5" x 3' 1", 3' 1" x 3' 8", 2' 7" x 3' 3", 1' 3",	{ 27.4* } 31.8† } 23.7 }	4,509	Nov. 30, 1894
32	Charlestown,	Metropolitan Construction Co.,	4,705	{ 2' 7" x 3' 3", 2' 5" x 3' 1", 2' 3" x 3', 2' 1" x 2' 10", 1' 7" x 2' 4",	{ 29.5 } 29.0 } 16.8 } — }	869 2,214 678 944	Nov. 30, 1894
32	Charlestown Navy Yard,	Day work,	1,572	{ 2' 1" x 2' 10", 1' 10" x 2' 7", 1' 7" x 2' 4",	{ 19.2* } 16.8† }	992 680	-
35	Charlestown, Somerville and Medford,	James Heath & Son,	8,370	{ 3' 4" x 4' 1", 3' 3" x 3' 11", 2' 11" x 3' 7", 1' 10" x 2' 8",	{ 29.0* } 29.0† } 21.7 }	*214 †3,872 *4,230 †54	Nov. 30, 1894
36	East Boston,	National Construction Co.,	237	1' 3" vitrified pipe,	18.5	237	Sept. 30, 1894
37	East Boston,	John Sheehan,	4,882	{ 3' 4" x 3' 9", 3' x 3' 5",	{ 30.0 } 26.5* } 31.0† }	*2,144 †2,738	June 30, 1894

87½ East Boston,	Day work,	276	3' 6" X 3' 10", . . . . .	. . . . .	28.0†	276	-
88 East Boston,	James Heath & Son,	8,329	$\left\{ \begin{array}{l} 3' \times 3' 5", \\ 2' 6", \\ 1' 6", \\ 1' 3", 1', \end{array} \right.$	. . . . .	$\left\{ \begin{array}{l} 24 \\ 21 \\ 20 \\ 18 \end{array} \right.$	8,329	Nov. 15, 1894
89 East Boston,	Metropolitan Construction Co.,	6,944	$\left\{ \begin{array}{l} 1' 6", \\ 1' 3", 1', \end{array} \right.$	. . . . .	$\left\{ \begin{array}{l} 21 \\ 14.5 \end{array} \right.$	6,944	Oct. 30, 1894
41 Malden,	Day work,	1,014	2' 1" X 3' 2", 1' 8" X 2' 6", . . . . .	. . . . .	10.0	1,014	-
42 Melrose and Stoneham,	David L. Clements,	3,060	1' pipe, . . . . .	. . . . .	11.4	3,060	Nov. 30, 1893
43 Somerville and Cambridge,	Metropolitan Construction Co.,	14,450	$\left\{ \begin{array}{l} 2' 11" \times 3' 6", \\ 2' 6" \times 3' 1", \\ 2' 3" \times 2' 11", 1' 11" \times 3' 9", \\ 1' 6" \text{ pipe,} \\ 1' 3" \text{ pipe,} \end{array} \right.$	. . . . .	$\left\{ \begin{array}{l} 20.0^* \\ 23.0† \\ 10.5^* \\ 16.0† \\ 7.0 \\ 7.0 \end{array} \right.$	14,450	Oct. 31, 1893
43½ Medford and Somerville,	Metropolitan Construction Co.,	2,312	3' X 3' 1", 2' 11" X 3' 6", . . . . .	. . . . .	13.1	2,312	Aug. 31, 1893
43½ Siphon, Mystic River,	Day work,	150	6' X 17' sand-catcher, 2' pipe siphon, . . . . .	. . . . .	-	150	-
44 Winchester,	Jones & Meehan,	5,606	2' 7" X 2' 11", 2' 3' X 2' 6", 2' X 2' 6", . . . . .	. . . . .	$\left\{ \begin{array}{l} 13.6^* \\ 20.0† \end{array} \right.$	5,606	Nov. 30, 1893
44½ West Medford and Winchester,	Weaving, Booth & Co.,	5,805	2' 11" X 3' 3", 2' 9" X 3' 1", . . . . .	. . . . .	12.0	5,805	Mar. 31, 1894
44½ Siphon, Abbejous River,	Abandoned contract work,	80	6' X 14' sand-catcher, 1' 8" pipe siphon, . . . . .	. . . . .	4.0	80	-
45 Winchester,	Everson & Liddle,	6,508	2' X 2' 5", 1' 10" X 2' 3", . . . . .	. . . . .	9.0	6,508	Sept. 30, 1893
46 Winchester, Woburn and Stoneham,	Charles Linchan,	5,757	$\left\{ \begin{array}{l} 1' 10" \times 2' 3", 1' 8" \times 2', \\ 1' 8" \text{ pipe,} \end{array} \right.$	. . . . .	$\left\{ \begin{array}{l} 10.0 \\ 9.7^* \\ 21.9† \end{array} \right.$	5,757	Aug. 31, 1893
47 Winchester and Woburn,	Lindsay & Codmore,	4,510	1' 8", 1' 6", 1' 8" pipe, . . . . .	. . . . .	8.0	4,510	Aug. 31, 1894
48 Somerville, Arlington and Medford,	Day work,	1,537	$\left\{ \begin{array}{l} Decatur Street, 15" \text{ pipe,} \\ Jerome Street, 12" \text{ pipe,} \\ Boston Avenue, 10" \text{ pipe,} \end{array} \right.$	. . . . .	-	$\left\{ \begin{array}{l} 456 \\ 553 \\ 678 \end{array} \right.$	-

* Trench.

† Tunnel.

TABLE OF SEWER WORK COMPLETED, ETC. — Concluded.

Section.	LOCALITY.	NAME OF CONTRACTOR.	Total Length of Section, Feet.	Size of Sewer.	Size of Sewer.	Average Depth of Trench, Bottom of Deeper Excavation, Feet.	Length of Sewer completed Rept. 30, 1894, Feet.	Date of Completion named in Contract.
12	Dorchester,	Day work,	986	3'X3'1",	.	16.0*	575	-
					.	25.0†	60	
13	Dorchester,	H. P. Nawn,	3,800	3'X3'1",	.	11.8*	3,831	Oct. 1, 1896
					.	18.0†	-	
14	Dorchester,	H. P. Nawn,	1,928	3'X3'1",	.	10.2	1,928	Oct. 1, 1896
				2'6"X2'1",	.	14.3	-	
15	Dorchester and Hyde Park,	H. P. Nawn,	2,470	3'6"X2'1",	.	15.6	1,484	Dec. 1, 1896
				4'6"X4'1",	.	18.9	96	
16	Hyde Park,	H. P. Nawn,	2,374	4'6"X4'1",	.	25.4*	371	Dec. 1, 1896
				4'3"X5'4",	.	27.9†	96	
					.	20.5*	-	
17	Hyde Park,	Geo. H. Newman & Co.,	1,768	4'3"X4'4",	.	16.0*	802	Jan. 1, 1897
					.	30.4†	-	

* Trench.

† Trench.

OFFICE ASSISTANTS.

In addition to the assistant engineers and other assistants above referred to, the following office assistants have been employed for the whole and parts of the year : —

Assistant Engineers : —

Charles H. Swan,* special hydraulic studies and calculations.

Winslow Blanchard,* mechanical studies, maintenance and equipment of pumping stations.

Frank I. Capen, in charge of day-work construction and maintenance studies.

Francis L. Sellew, in charge of surveys and draughting.

Charles E. Hathaway, in charge of records.

Assistants. — Theodore Horton,† B. A. Clark, E. W. Brown,† day-work construction and maintenance studies.

Draughtsmen : —

William J. Watkins.

Frank A. Emery.

Arthur H. Pratt.

Harry C. Dove.

Richard J. McNulty.†

Stenographer. — Henry P. Fielding.

Clerk. — Burton W. Torrey.

Cement Tester. — Nelson A. Hallett.*

Messenger. — Madison C. Lewis.

MAINTENANCE.

The pumping plants at all the stations have been in operation during the year and have given most excellent results.

Early in the year the pumps were not run more than 4 hours per day. As the sewage from additional areas was received from time to time into the mains, this time was increased to 12 to 16 hours per day, to avoid closing the regulators of connected low areas. Since Sept. 1, 1896, the pumps have operated continuously for 24 hours at all the stations. This method has been found economical, convenient and otherwise better than an intermittent service. The greatest pumping for any single day during the year occurred on Sept. 10, 1896, during a continued heavy storm. The record for that day is as follows : —

	Gallons.
Deer Island pumping station,	35,610,000
East Boston pumping station,	32,400,000
Charlestown pumping station,	20,412,000
Alewife Brook pumping station,	3,434,000

The total pumpage and average lifts for the year appear in the following table : —

* Engaged for a portion of his time only by the Metropolitan Sewerage Commission.

† For a portion of the year.

Table of Approximate Quantities and Lifts at Pumping Stations of North Metropolitan System.

EAST BOSTON STATION.			CHARLESTOWN STATION.			ALEWISSE BROOK STATION.		
Total Pumpage.	Average Lift.		Total Pumpage.	Average Lift.		Total Pumpage.	Average Lift.	
Gallons.	Feet.		Gallons.	Feet.		Gallons.	Feet.	
235,817,000	11.9		139,111,000	9.3		57,947,000	12.7	
338,580,000	14.2		140,585,000	7.4		70,944,000	11.7	
294,577,000	13.9		84,672,000	8.4		60,376,000	12.3	
288,320,000	13.0		84,779,000	8.3		44,500,000	12.7	
-	-		-	-		-	-	
238,169,000	13.7		98,280,000	6.9		58,893,000	12.6	
257,440,000	14.2		126,213,000	7.1		64,850,000	13.2	
313,390,000	13.3		27,722,000	7.8		40,466,000	13.3	
245,322,000	13.0		180,399,000	9.2		26,623,000	13.2	
313,771,000	13.2		208,828,000	8.9		32,718,000	12.8	
266,285,000	13.0		239,139,000	8.0		38,006,000	12.7	
547,904,000	14.6		349,920,000	8.0		48,914,000	12.7	
3,530,555,000	13.5		1,620,566,000	8.1		842,336,000	12.7	

* From January 31 to March 9, inclusive, during the illness of the pumping plants at Deer Island and East Boston, the system was not operated.

† During the trials of the pumping plant at the Charlestown station, April 24 to May 24, inclusive, no sewage was pumped at that station.

It appears from the table that the amount pumped at East Boston is 90 per cent., at Charlestown 42 per cent. and at Alewife Brook 14 per cent. of the total yearly delivery at the outfall.

Thirty-six connections have now been made with the Metropolitan main in cities and towns in the Charles-river area. These provide an outlet for approximately 208.40 miles of local sewers. The population now using these local sewers is estimated at 50,540 persons. This area embraces about 42 square miles, of which 45 per cent. is sewered and connected with the Metropolitan System. It is estimated that 50 per cent. of the population resident upon the whole area is contributing sewage to the system.

The following table, compiled from returns made by the several cities and towns, gives additional data relating to uses made of the Metropolitan System within the Charles-river area to date : —

CHARLES RIVER VALLEY SYSTEM.

Table showing Cities and Towns delivering Sewage to This System; Approximate Miles of Sewer connected; Estimated Populations and Areas now contributing; Total Areas ultimately to contribute, and Present Populations on such Areas; Ratios of Present Contributing Areas to Ultimate Areas, and Ratios of Populations now contributing to Present Total Populations.

CITIES AND TOWNS.	Miles of Local Sewer connected.	Separate or Combined.	Number of Connections with Local Sewers.	Estimated Number of Persons served by Each House-connection.*	Estimated Population now contributing Sewage.	Estimated Present Total Population.	Square Miles. now contributing Area.	Square Miles. ultimately to contribute Sewage.	Ratio of Contributing Population to Present Total Population.	Per Cent.	Ratio of Contributing Area to Ultimate Area.
Part of Boston (proper),	13.20	Separate and combined.	674	5.1	8,437	11,930	1.00	1.61	28.80	62.00	
Boston (Brighton),	27.10	Separate and combined.	1,561	5.1	7,961	15,590	2.90	4.27	51.20	68.00	
Brookline,	44.21	Combined,	1,689	6.6	11,147	16,970	2.80	4.84	65.70	57.80	
Newton,	66.80	Separate,	2,531	5.2	13,161	28,271	8.92	13.60	46.60	65.60	
Watertown,	20.10	Separate,	794	4.7	3,732	7,931	0.97	4.04	47.00	24.00	
Waltham,	37.03	Separate,	2,135	5.2	11,102	21,311	2.17	13.63	52.20	15.90	
	208.44	- - -	9,384	5.4	50,540	102,003	18.76	41.99	49.50	44.70	

* This is estimated from assessors' statement of the number of houses in each city or town, and the population from census of 1896 extended to 1896.

Fifty-four connections have now been made with the North Metropolitan System in cities and towns within the area. These provide an outlet for approximately 253.70 miles of local sewers. The population now using these local sewers is estimated at 98,703 persons. This area embraces about 73 square miles, of which 22 per cent. is sewered and connected with the Metropolitan System. It is estimated that 26 per cent. of the population resident upon the whole area is contributing sewage to the system.

The following table, compiled from returns made by the several cities and towns, gives additional data relating to uses of the North Metropolitan System : —

NORTH METROPOLITAN SYSTEM.

Table showing Cities and Towns delivering Sewage to This System; Approximate Miles of Sewer connected; Estimated Populations and Areas now contributing; Total Areas ultimately to contribute, and Present Populations on such Areas; Ratios of Present Contributing Areas to Ultimate Areas, and Ratios of Populations now contributing to Present Total Populations.

CITIES AND TOWNS.	Miles of Local Sewer connected.	Separate or Com- bined.	Number of Con- nections with Local Sewers.	Estimated Number of Persons served per Each House. *connection.	Estimated Popula- tion now contrib- uting Sewage.	Estimated Present Total Population.	Estimated Area now contributing Sewage.	Square Miles. Area ultimately to contribute Sew- age.	Ratio of Contribut- ing Population to Present Total Population.	Per Cent.	Ratio of Contribut- ing Area to Uti- mate Area.
Boston (Deer Island), . .	0.20	-	-	-	1,000†	-	-	-	-	-	-
Winthrop,	17.90	Separate,	980	3.6	3,528	4,485	1.01	1.61	78.70	62.80	-
Boston (East Boston), . .	1.01	Separate and combined.	114	8.6	980	43,527	0.04	2.18	22.50	1.80	-
Everett,	9.10	Separate,	331	5.1	1,688	20,080	0.92	3.34	8.40	27.60	-
Malden,	32.00	Separate,	1,766	5.3	9,860	31,041	2.58	5.07	30.20	50.90	-
Melrose,	17.07	Separate,	535	4.2	2,247	12,655	1.56	3.78	17.80	41.90	-
Cambridge,	87.65	Separate and combined.	8,271	6.5	53,762	83,817	3.77	6.11	64.20	61.70	-
Somerville,	19.23	Separate and combined.	3,289	5.5	18,089	54,601	0.82	3.96	33.10	20.70	-
Medford,	35.12	Separate,	792	5.1	4,039	15,160	1.74	8.35	26.60	20.80	-
Winchester,	13.81	Separate,	164	5.3	869	6,403	0.99	5.95	13.50	16.70	-
Woburn,	10.58	Separate,	456†	5.3	2,416	14,311	1.24	12.70	16.90	9.80	-
Arlington,	6.35	Separate,	83	5.6	185	6,692	1.04	5.20	27.70	20.00	-
Belmont,	3.64	Separate,	28§	5.6	540	2,992	0.47	4.66	18.10	10.00	-
{ Boston (Charlestown), . .	-	-	-	-	-	40,139	-	1.27	-	-	-
{ Chelsea,	-	-	-	-	-	31,972	-	2.24	-	-	-
{ Stoneham,	-	-	-	-	-	6,310	-	5.50	-	-	-
{ Wakefield,	-	-	-	-	-	641	-	0.95	-	-	-
	253.65	-	16,759	5.9	98,703	374,826	16.18	72.82	26.30	22.20	-

* This is estimated from assessors' statement of the number of houses in each city or town, and the population from census of 1895 extended to 1896.
† Estimated by Superintendent J. R. Gerrish of the Institution on Deer Island.
‡ Exclusive of Mystic Valley sewer and tanneries.
§ Including 3 connections with Massachusetts General Hospital, having an estimated population of 400. || Charlestown, Chelsea, Stoneham and Wakefield not connected.

Careful measurements of losses of head at all the Metropolitan siphons have been made at intervals during the year. They indicate that no deposits of any consequence have thus far occurred in the siphons.

All the Metropolitan sewers are now satisfactorily clean and in a normal condition. Hand-cleaning and flushing have been required several times on the Mystic Valley branch, acquired from the city of Boston, and now receiving tannery sewage from Winchester and Woburn.

The outlet at Deer Island has operated satisfactorily during the year. A minute examination of the Deer Island bar and the adjacent shores has been made, and no deposits due to the discharge of sewage have been found. Under the most unfavorable conditions of wind and tide, the presence of sewage can be detected hardly more than 100 feet from the outlet.

I desire to thank you for your continued courtesy and kindness during the year, and to express an appreciation of the efficient service of all the employees in the engineering department.

Respectfully submitted,

WILLIAM M. BROWN, JR.,
Chief Engineer and Superintendent.

APPENDIX.

TABLE A.— Miscellaneous Bids upon the North Metropolitan System.

NAMES OF BIDDERS.	RESIDENCE.	DEER ISLAND PUMPING STATION.			CHARLESTOWN PUMPING STATION.		
		COAL. ¹	Bids opened Oct. 26, 1896.	COAL. ¹	COAL. ¹	Bids opened Dec. 7, 1896.	INTERIOR FINISH. Bids opened Oct. 26, 1896.
C. A. Campbell & Co.,	Boston, .	\$3 62 ³	\$3 89 ³	\$3 89 ³	\$3 55 ³	-	\$3 89 ³
Alden & Nevin, .	Boston, .	3 85 ³	3 87 ³	3 87 ³	-	-	3 87 ³
Curren & Burton, .	Boston, .	*3 45 ³	-	-	3 55 ³	-	3 64 ³
Garfield & Proctor, .	Boston, .	{ 3 95 ⁴	*3 49 ³	*3 49 ³	-	-	*3 49 ³
J. Robbins & Co.,	Boston, .	{ 3 75 ³	4 60 ³	4 60 ³	4 20 ³	-	4 35 ³
J. Albert Walker & Co.,	Boston, .	-	-	-	3 70 ³	-	-
B. F. Wild & Co.,	Boston, .	-	-	-	3 65 ³	-	-
New Central Coal Company,	Maryland,	3 63 ³	-	-	-	-	-
Mack & Moore, .	Boston, .	-	-	-	-	\$2,250 00	-
Wm. Richmond & Co.,	Boston, .	-	-	-	-	1,909 00	-
John S. Jacobs & Son,	Boston, .	-	-	-	-	1,975 00	-
Hersee Bros., .	Boston, .	-	-	-	-	5,800 00	-
William H. Keyes & Co.,	Boston, .	-	-	-	-	*1,848 00	-
L. G. Burnham & Co.,	Boston, .	-	3 69 ³	3 69 ³	-	-	3 69 ³
John Morrison, .	Boston, .	-	3 59 ³	3 59 ³	-	-	3 59 ³
E. B. Townsend, .	Boston, .	-	3 55 ³	3 55 ³	-	-	3 88 ³
Philip H. Butler & Co.,	Boston, .	-	-	-	-	-	-
Bowker, Torrey & Co.,	Boston, .	-	-	-	-	-	-
Chas. E. Hall & Co., .	Boston, .	-	-	-	-	-	-
Abberthaw Construction Company, .	Boston, .	-	-	-	-	-	-

¹ Bids in all cases based upon long ton.
² Bituminous.
³ Cumberland.
⁴ Borden Mine.
⁵ Pocahontas.
⁶ Contract awarded.
⁷ Barton Mine.

TABLE B. — Bids for Construction of Sections upon the Neponset Valley System.

NAMES OF BIDDERS.	RESIDENCE.	BIDS OFFERED MARCH 21, 1896.		BIDS OFFERED MARCH 23, 1896.		BIDS OFFERED APRIL 15, 1896.	
		Section 13, Dorchester.	Section 14, Dorchester.	Section 15, Dorchester and Hyde Park.	Section 16, Hyde Park.	Section 17, Hyde Park.	Section 18, Hyde Park.
A. W. Bryne Construction Co.,	Boston, Mass.,	\$48,597 00	\$39,649 00	\$43,754 00	\$36,921 00	-	-
Edward W. Everson,	Boston, Mass.,	48,873 00	29,848 50	47,467 50	46,885 00	-	-
Jones & Meehan,	Jamaica Plain, Mass.,	42,947 50	33,790 00	44,613 00	46,869 00	\$34,236 50	\$38,880 00
Troy Public Works Co.,	Troy, N. Y.	37,808 00	26,585 00	37,115 00	35,450 00	32,907 00	*33,820 00
Frank L. Allen,	"	37,376 50	33,871 00	45,686 50	48,177 00	-	-
F. A. Snow,	"	36,090 00	25,280 00	43,953 25	42,788 75	33,086 60	34,433 00
J. P. O'Connell,	"	35,887 50	28,941 00	-	-	-	36,931 50
Quimby & Ferguson,	"	34,668 55	23,861 00	37,755 65	34,172 60	33,318 95	48,232 20
H. A. Hanscom & Co.,	"	34,584 50	27,074 25	52,149 50	39,828 00	-	-
H. P. Nawn,	"	*29,972 00	*21,814 80	*36,062 50	*33,231 00	-	-
Crab & Trumbull,	"	-	28,076 00	39,718 00	54,816 50	-	-
T. H. Bryne & Co.,	"	-	25,717 50	-	39,131 00	-	-
Geo. B. Newman & Co.,	"	-	-	36,793 75	33,247 65	*27,170 20	36,742 00
William T. Ross,	"	-	-	-	-	-	27,378 50
Asb & Co.,	Waltham, Mass.,	-	-	-	-	-	-
John H. McNight,	Pittsburg, Pa.	-	-	-	-	-	-
Geo. S. Good & Co.,	"	-	-	-	-	-	-
S. W. Frescoln,	"	-	-	-	-	-	-
Ezra A. Mathers,	"	-	-	-	-	-	-
Michael Sullivan,	Cincinnati, O.,	-	-	-	-	-	-
Richard A. Malone & Son,	Boston, Mass.,	-	-	-	-	-	-
Haskin & Murphy,	Charlestown, Mass.,	-	-	-	-	-	-

* Contract awarded.

TABLE B. — Bids for Construction of Sections upon the Neponset Valley System — Concluded.

NAMES OF BIDDERS.	RESIDENCE.	BIDS OPENED APRIL 25, 1896.		BIDS OPENED JUNE 13, 1896.		BIDS OPENED JUNE 27, 1896.		
		Section 19, Hyde Park.	Section 20, Hyde Park.	Section 21, Hyde Park and Dedham.	Section 22, Dedham.	Section 23, Dedham.	Section 24, Dedham.	Section 25, Dedham.
A. W. Bryne Construction Co.,	Boston, Mass.,	-	-	-	-	-	-	-
Edward W. Everson,	Boston, Mass.,	-	-	-	-	-	-	-
Jones & Meehan,	Jamaica Plain, Mass.,	\$32,305 25	\$38,372 60	-	-	-	-	-
Troy Public Works Co.,	Troy, N. Y.,	25,443 30	29,581 70	-	-	-	-	-
Frank L. Allen,	-	-	-	-	-	-	-	-
F. A. Snow,	-	26,494 50	36,767 50	-	-	-	-	-
J. P. O'Connell,	-	27,639 90	37,757 05	-	-	-	-	-
Quimby & Ferguson,	-	26,145 44	34,103 09	-	-	-	-	-
H. A. Hanscom & Co.,	West Medford, Mass.,	-	-	-	-	-	-	-
H. P. Nawn,	Boston, Mass.,	-	-	39,700 00	42,414 00	53,732 00	59,273 00	-
Craig & Trumbull,	-	26,698 00	-	-	37,482 00	-	47,030 00	36,190 00
T. H. Bryne & Co.,	-	-	-	43,730 00	46,417 00	-	-	-
Geo. R. Newman & Co.,	-	26,613 90	29,761 69	47,186 50	52,702 00	-	-	-
William T. Ross,	Waltham, Mass.,	-	-	-	-	-	-	-
Aab & Co.,	Waltham, Mass.,	30,953 85	37,351 40	-	-	-	-	-
John H. McNight,	Pittsburg, Pa.,	28,449 70	-	-	-	-	-	-
Geo. S. Good & Co.,	Lock Haven Pa.,	*24,814 35	*27,219 00	76,342 50	67,822 00	-	-	-
S. W. Frescoln,	-	-	34,637 30	-	41,671 00	47,603 25	55,267 50	-
Ezra A. Mathers,	D. C.,	-	-	*84,712 50	*98,800 90	-	-	-
Michael Sullivan,	-	-	-	-	-	62,934 00	70,195 50	47,472 00
Richard A. Malone & Son,	-	-	-	-	-	45,357 50	37,613 00	29,043 00
Haskin & Murphy,	Charlestown, Mass.,	-	-	-	-	*34,556 00	*39,113 50	-

* Contract awarded.

TABLE C. — *Neponset Valley System* — Concluded.

SECTIONS.	LOCATION.	Contract awarded to —	Residence.	Amount Bid on Items for Comparison.	Work began.	To be completed.	Length of Section.
Section 13, .	Dorchester, Mass.,	H. P. Nawn, . . .	Boston, Mass., .	\$29,972 00	April 6, 1896,	Oct. 1, 1896,	Feet. 3,800
14, .	Dorchester, Mass.,	H. P. Nawn, . . .	Boston, Mass., .	21,814 80	6, 1896,	1, 1896,	1,927
15, .	Dorchester, Mass.,	H. P. Nawn, . . .	Boston, Mass., .	36,062 50	6, 1896,	Dec. 1, 1896,	2,470
16, .	Hyde Park, Mass.,	H. P. Nawn, . . .	Boston, Mass., .	33,231 00	6, 1896,	1, 1896,	2,370
17, .	Hyde Park, Mass.,	George R. Newman & Co.,	Providence, R. I.,	27,170 20	May 11, 1896,	Jan. 1, 1897,	1,766
18, .	Hyde Park, Mass.,	Troy Public Works Co.,	Troy, N. Y., . .	33,820 00	11, 1896,	1, 1897,	2,720
19, .	Hyde Park, Mass.,	George S. Good & Co.,	Lock Haven, Pa.,	24,814 35	18, 1896,	1, 1897,	2,642
20, .	Hyde Park, Mass.,	George S. Good & Co.,	Lock Haven, Pa.,	27,219 00	22, 1896,	Feb. 1, 1897,	3,228
21, .	Hyde Park, Mass.,	Ezra A. Mathers, .	Washington, D. C.,	34,712 50	July 11, 1896,	April 1, 1897,	3,600
22, .	Dedham, Mass., .	Ezra A. Mathers, .	Washington, D. C.,	33,800 90	20, 1896,	1, 1897,	2,400
23, .	Dedham, Mass., .	Haskin & Murphy, .	Charlestown, Mass.,	34,556 00	11, 1896,	June 1, 1897,	2,600
24, .	Dedham, Mass., .	Haskin & Murphy, .	Charlestown, Mass.,	39,113 50	11, 1896,	1, 1897,	2,470
25, .	Dedham, Mass., .	Edward W. Everson, .	Boston, Mass., .	30,115 00	27, 1896,	April 1, 1897,	2,670
				<u>\$406,401 75</u>			

TABLE D. — *Maintaining and Operating North Metropolitan System of Sewerage.*

		Dr.							
1894.									
Feb.	15,	Balance Sept. 30, 1895,	.	.	.	.	.	.	\$68,045 26
		To appropriation made by chapter 77, Acts of 1896,	.	.	.	.	.	.	91,500 00
									<u>\$159,545 26</u>
1895.									
Oct.	31,	By pay rolls for month, general,	.	.	.	.	.	\$1,383 91	
	31,	By supplies for "	.	.	.	.	.	1,057 78	
	31,	By pay rolls for "	.	.	.	.	.	679 48	
	31,	By supplies for month, Deer Island station,	.	.	.	.	.	344 33	
	31,	By pay rolls for month, East Boston station,	.	.	.	.	.	274 91	
	31,	By supplies for month, East Boston station,	.	.	.	.	.	277 85	
	31,	By pay rolls for month, Charlestown station,	.	.	.	.	.	336 89	
	31,	By supplies for month, Charlestown station,	.	.	.	.	.	206 70	
	31,	By pay rolls for month, Alewife Brook station,	.	.	.	.	.	254 52	
	31,	By supplies for month, Alewife Brook station,	.	.	.	.	.	171 97	
	31,	By proportionate expenses, commissioners, chief engineer, clerk and others for month,	.	.	.	.	.	750 00	
									\$5,738 34
Nov.	30,	By pay rolls for month, general,	.	.	.	.	.	\$1,192 23	
	30,	By supplies for month, general,	.	.	.	.	.	917 40	
	30,	By pay rolls for month, Deer Island station,	.	.	.	.	.	699 94	
	30,	By supplies for month, Deer Island station,	.	.	.	.	.	293 06	
	30,	By pay rolls for month, East Boston station,	.	.	.	.	.	287 95	
	30,	By supplies for month, East Boston station,	.	.	.	.	.	284 95	
	30,	By pay rolls for month, Charlestown station,	.	.	.	.	.	361 60	
	30,	By supplies for month, Charlestown station,	.	.	.	.	.	347 12	
	30,	By pay rolls for month, Alewife Brook station,	.	.	.	.	.	312 20	

April	By pay rolls for month, general,	.	.	.	.	.	\$992 88
30.	By supplies for month, general,	.	.	.	.	.	136 55
30.	By pay rolls for month, Deer Island station,	.	.	.	.	.	549 12
30.	By supplies for month, Deer Island station,	.	.	.	.	.	-
30.	By pay rolls for month, East Boston station,	.	.	.	.	.	527 82
30.	By supplies for month, East Boston station,	.	.	.	.	.	13 79
30.	By pay rolls for month, Charlestown station,	.	.	.	.	.	384 68
30.	By supplies for month, "	.	.	.	.	.	4 65
30.	By pay rolls for month, "	.	.	.	.	.	189 24
30.	By supplies for month, /	.	.	.	.	.	-
30.	By proportionate expenses	.	.	.	.	.
30.	month,	.	.	.	.	.	750 00
		.	.	.	.	.	3,548 73
May	By pay rolls for month, general,	.	.	.	.	.	\$1,266 58
31.	By supplies for month, general,	.	.	.	.	.	748 32
31.	By pay rolls for month, Deer Island station,	.	.	.	.	.	516 20
31.	By supplies for month, Deer Island station,	.	.	.	.	.	624 10
31.	By pay rolls for month, East Boston station,	.	.	.	.	.	470 98
31.	By supplies for month, East Boston station,	.	.	.	.	.	454 36
31.	By pay rolls for month, Charlestown station,	.	.	.	.	.	180 79
31.	By supplies for month, Charlestown station,	.	.	.	.	.	555 54
31.	By pay rolls for month, Alewife Brook station,	.	.	.	.	.	448 67
31.	By annuities for month, Alewife Brook station,	.	.	.	.	.	264 52
31.	By expenses, commissioners, chief engineer, clerk and others for	.	.	.	.	.	500 00
		.	.	.	.	.	6,025 01
	Amounts carried forward,	.	.	.	.	.	\$57,648 23
		.	.	.	.	.	\$159,545 26

[illegible]

Feb. 29,	By amount paid for salaries for commissioners, etc., to date,	.	.	.	\$300 00		
29,	" " for labor for month,	.	.	.	211 00		
29,	" " for supplies for month,	.	.	.	80 19	591 19	
March 31,	By amount paid for salaries, commissioners, etc., to date,	.	.	.	\$300 00		
31,	" " for labor for month,	.	.	.	188 00		
31,	" " for supplies for month,	.	.	.	21 84	509 84	
April 11,	By amount paid city of Boston				\$6,750 00		
30,	" " for salaries				50 00		
30,	" " for labor for				182 50		
30,	" " for supplies for month,				34 84	6,967 34	
May 31,	By amount paid for salaries, commissioners, etc., to date,	.	.	.	\$50 00		
31,	" " for labor for month,	.	.	.	306 64		
31,	" " for supplies for month,	.	.	.	93 47	450 11	
June 30,	By amount paid for salaries, commissioners, etc., to date,	.	.	.	\$50 00		
30,	" " for labor for month,	.	.	.	212 00		
30,	" " for supplies for month,	.	.	.	8 75	270 75	
July 8,	By amount paid city of Boston				\$6,750 00		
31,	" " for salaries				370 00		
31,	" " for labor for				218 00		
31,	" " for supplies for month,				12 18	7,346 18	
	Amounts carried forward,	.	.	.	.	\$30,157 42	\$44,296 35

EXPENDITURES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS TO SEPT. 30, 1896.

	Year ending Sept. 30, 1889.	Year ending Sept. 30, 1890.	Year ending Sept. 30, 1891.	Year ending Sept. 30, 1892.	Year ending Sept. 30, 1893.	Year ending Sept. 30, 1894.	Year ending Sept. 30, 1895.	Year ending Sept. 30, 1896.	Totals.
Office expenses, . . .	\$1,161 29	\$28,792 85	\$30,437 29	\$31,220 76	\$35,191 97	\$33,669 39	\$19,652 19	-	-*
North Metropolitan system, .	-	116,492 55	582,966 06	962,798 49	1,172,269 02	1,115,190 19	606,488 61	\$400,349 58	\$4,956,554 50
Charles River system, . .	-	18,329 41	381,149 33	280,308 29	28,882 27	25,369 13	1,927 35	52,831 53	788,797 31
Both systems, . . .	-	2,696 20	5,597 86	7,703 15	12,783 61	15,864 20	302 20	-	-*
Neponset valley system, .	-	-	-	-	-	-	2,649 95	200,604 35	203,254 30
Wakefield branch, . .	-	-	-	-	-	-	-	125 98	125 98
	\$1,161 29	\$166,311 01	\$1,000,150 54	\$1,282,030 69	\$1,249,126 87	\$1,190,092 91	\$631,020 30	\$653,911 44	\$5,948,732 09
Total expended to Sept. 30, 1896, \$5,948,732 09									

* The accounts "Office expenses" and "Both systems" are charged off to the North Metropolitan system and the Charles River valley system, — 85 per cent. to the former and 15 per cent. to the latter (North Metropolitan system, \$191,312.02, Charles River valley system, \$33,760.94). This is the proportion made by the apportionment commission in 1891 and has been found by experience to be substantially correct.

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS FOR THE YEAR ENDING SEPT. 30, 1896.

North Metropolitan System.

	1895.			1896.			
	October.	November.	December.	January.	February.	March.	April.
Sal: inspectors and all others,	\$2,179 48	\$779 25	\$2,174 56	-	\$138 79	\$1,441 95	\$675 12
TOTALS	14 00	115 09	11 71	-	6 17	3 04	21 33
Recording.	66 70	-	-	-	-	-	-
	725 09	17,524 01	3 29	\$8,996 19	394 63	-	2,462 37
	9 80	1 95	1 05	-	-	-	-
	116 70	113 52	-	14 00	-	6 52	10
	20 75	-	-	-	22 05	-	-
	778 35	1,000 00	-	197 55	1,520 27	-	-
Ass,	-	6 73	60	-	-	-	-
	-	1 75	-	-	-	-	-
	-	-	3 26	-	-	-	-
	-	-	-	-	35	-	2 50
	10 75	204 12	-	-	-	-	-
	-	66 78	-	-	-	-	-
	3,084 70	2,848 47	1,676 78	989 99	8 08	-	-
1 Wintrop—	38 66	11 79	-	-	-	-	-
Section No. 11, Chelsea—Chas. Linehan, contractor.	-	-	1,235 03	-	-	-	-
Section No. 14, Chelsea—Metropolitan Construction Company, contractors.	-	-	-	2,318 65	-	-	-

*Section No. 25, Mystic River siphon, Section No. 26, Charlestown and Somerville —H. P. Nawn, contractor.	20 00	-	-	-	-	-	-	-	30 50
Lindsey & Cud-	16 00	-	-	-	-	-	-	-	-
Jones & Meehan, contractors.	-	-	-	-	-	-	-	-	-
See	-	6 55	-	-	1,040 72	-	-	-	-
See	-	20	248 61	-	747 71	-	-	-	-
See	1,867 15	1,528 02	10 18	-	579 29	5,494 08	-	-	-
Medford—Jas. Heath & Son, contractors. Section No. 38, East Boston—Jas. Heath & Son, contractors.	96 59	231 76	383 77	90 12	1,740 75	-	-	-	-
*Section No. 39, East Boston, Section No. 43, Somerville and Cambridge— Metropolitan Construction Company, con- tractors.	-	82 16	1 94	-	-	-	-	-	-
	-	4 10	-	-	-	-	-	-	-
*Section No. 48, Winchester, Four-family dwelling-house at Deer Island— Hersee Bros., contractors.	725 13	36 60	4 13	-	-	1 67	-	-	6 25
	1,340 26	3,713 56	1,487 50	-	1,549 28	2,316 73	-	-	-
*East Boston pumping station,	50 49	142 00	362 94	13 80	-	452 64	935 97	318 21	
*Deer Island pumping station,	775 67	1,654 95	687 52	-	-	1,698 06	1,161 09	795 51	
	1,170 70	1,068 93	1,148 06	-	2,519 53	806 07	72 56	223 76	
1, station—Edw.	1,131 55	2,304 12	893 68	-	1,282 15	443 93	362 00	36 90	
	-	-	-	-	-	-	-	15,050 00	
Pumps for East Boston pumping station—Edw. P. Allis Company, contractors.	-	-	-	-	-	-	-	17,050 00	

* Work done by day labor.

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS FOR THE YEAR ENDING SEPT. 30, 1896 — Continued.

North Metropolitan System — Continued.

	1895.			1896.*			
	October.	November.	December.	January.	February.	March.	April.
Pumps for Charlestown pumping station — Edw. P. Allis Company, contractors.	-	-	-	-	-	-	\$8,750 00
Charlestown pumping station — Edw. Lynch & Co., contractors.	\$2,550 00	\$4,028 14	-	-	\$363 42	-	-
Alewife Brook pumping station — Wm. T. Eaton, contractor.	-	1,886 15	\$743 47	-	114 88	-	-
East Boston coal-pocket — Wm. T. Eaton, con- tractor.	-	1,968 83	-	-	-	-	-
Deer Island Mack & Charlestown tractors.	4,165 00	3,400 00	1,700 00	\$3,155 15	-	-	354 36
East Boston screen-house — O'Connell & Fur- bish, contractors.	1,188 20	2,975 00	1,275 00	3,039 07	-	\$38 07	242 06
East Boston sea-wall — W. H. Wyman, con- tractor.	935 00	473 51	-	-	-	-	-
*Section No. 25½, Tufts' Mill Pond,	-	650 00	-	-	-	-	-
*Alewife Brook coal-pocket,	100 80	-	-	-	-	-	-
Grand totals,	\$23,125 52	\$48,827 44	\$14,053 08	\$26,528 19	\$16,017 07	\$4,021 20	\$46,018 96

* Work done by day labor.

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS FOR THE YEAR ENDING SEPT. 30, 1896 — Continued.

North Metropolitan System — Continued.

	1896					Totals.
	May.	June.	July.	August.	September.	
tors and all others,	-	\$296 80	\$119 11	-	-	\$7,900 06
•	-	-	1 14	-	-	172 48
•	-	-	210 00	-	-	276 70
•	-	-	-	-	-	80,105 58
•	-	-	-	-	-	12 80
•	-	-	-	-	-	250 84
•	-	-	-	-	-	42 80
•	-	-	-	-	\$838 76	4,384 92
•	-	-	-	-	-	7 33
•	-	-	-	-	-	1 75
•	-	-	-	-	-	8 26
•	-	-	-	-	-	2 85
•	-	-	-	-	-	214 87
•	-	-	-	-	-	66 78
•	-	-	5,001 50	-	-	13,559 52
•	-	-	-	-	-	50 45
•	-	-	-	-	-	1,285 03
•	-	-	-	-	-	2,313 65
•	-	-	-	-	-	20 00

Section No. 7, East Boston and Winthrop —
Trumbull & Ryan, contractors.

*Section No. 10, Chelsea Creek,.

Section No. 11, Chelsea — Chas. Linehan, con-
tractor.

Section No. 14,
struction Com]

*Section No. 25,

* Work done by day labor.

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS FOR THE YEAR ENDING SEPT. 30, 1896 — Continued
North Metropolitan System — Concluded.

	1896.					Totals.
	May.	June.	July.	August.	September.	
Section No. 26, Charlestown and Somerville — H. P. Nawn, contractor.	-	-	\$11 75	-	-	\$42 25
Section No. 29, Cambridge — Lindsey & Cud- more, contractors.	-	-	-	-	-	15 00
Section No. 30, Cambridge — Jones & Meehan, contractors.	-	-	417 20	-	-	417 20
Sex (atropolitan	-	-	-	-	-	1,047 27
Sex (atropolitan	-	-	295 50	-	-	1,292 02
Sex (rville and Medford — Jas. Heath & Son, contractors.	-	-	-	\$3,218 08	\$110 00	12,806 80
Section No. 38, East Boston — Jas. Heath & Sons, contractors.	-	\$23 50	13 50	29 80	115 60	2,725 99
and Cambridge — n Company, con-	-	-	3,522 50	-	166 98	3,773 58
at Deer Island —	-	-	-	-	-	4 10
at Deer Island —	\$200 75	-	-	-	-	773 78
at Deer Island —	-	18 59	116 55	1 67	15 00	2,492 86
at Deer Island —	-	1,210 52	1,008 84	64 16	98 99	9,154 71
*Charlestown pumping station,	445 85	591 04	675 96	42 86	26 85	8,792 15
*Alewife Brook pumping station,	-	165 72	24 31	-	30	6,644 66

Pumps for Deer Island pumping station — Edw. P. Allis Company, contractors.	-	-	-	-	-	-	15,050 00
Pumps for East Boston pumping station — Edw. P. Allis Company, contractors.	-	-	-	-	-	-	17,050 00
Pumps for East Boston pumping station — Edw. P. Allis Company, contractors.	-	10,250 00	-	-	-	-	19,000 00
Charlestown pumping station — Edw. Lynch & Co., contractors.	-	-	-	-	-	-	6,941 56
Alewife Brook pumping station — Wm. T. Eaton, contractor.	-	-	-	-	-	-	2,744 00
East Boston coal-pocket — Wm. T. Eaton, contractor.	-	-	-	-	-	-	1,968 83
Deer Island coal-pocket and screen-house — Mack & Moore, contractors.	-	-	-	-	-	-	12,774 51
Charlestown coal-pocket — Mack & Moore, contractors.	530 45	-	-	-	-	-	9,287 85
East Boston screen-house — O'Connell & Furbish, contractors.	-	-	-	-	-	-	1,408 51
East Boston sea-wall — W. H. Wyman, contractor.	-	-	-	-	-	-	650 00
*Section No. 254 — Tufts' Mill Pond,	-	-	-	-	-	-	100 80
*Alewife Brook coal-pocket,	-	-	-	-	-	980 00	980 00
Grand totals,	\$1,177 05	\$12,551 17	\$11,417 86	\$3,856 57	\$1,752 47	\$208,847 58	
Amount charged off from "Office Expenses" and "Both Systems" to Oct. 1, 1896,	.	.	.	.	.	191,312 02	
85 per cent. of office expenses for year ending Sept. 30, 1896,	.	.	.	.	.	189 98	
						\$400,349 58	

* Work done by day labor.

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS FOR THE YEAR ENDING SEPT. 30, 1896 — *Continued.*
Neponset Valley System.

	1895.			1896.			
	October.	November.	December.	January.	February.	March.	April.
Directors and all others,	\$841 45	\$258 68	\$1,448 39	\$0 75	\$1,248 29	\$1,462 40	\$1,454 17
" " " "	250 00	250 00	250 00	250 00	250 00	250 00	250 00
" " " "	13 40	5 80	6 44	21 75	51 15	-	138 04
" " " "	66 00	33 25	55 80	35 00	126 69	-	110 31
" " " "	1 55	6 50	3 85	-	3 05	-	21 50
Ac.,	48 95	12 58	4 05	-	11 00	-	2 98
" " " "	44 47	74 54	20 82	85 44	33 21	1 00	14 72
postage,	-	75	-	-	80	-	32 70
" " " "	-	10 16	12 85	50	14 23	-	11 50
" " " "	3 00	12 00	3 00	-	-	-	-
" " " "	-	516 66	516 67	-	-	-	516 66
" " " "	-	125 00	125 00	-	-	-	-
" " " "	-	125 00	125 00	-	-	-	-
" " " "	-	5 25	-	-	-	-	-
and repair of same,	-	-	-	-	-	-	-
" " " "	-	-	-	-	254 17	254 17	44 25
Repairs at building No. 1	-	-	-	-	-	-	254 17
" " " "	-	-	-	-	-	-	94 97
" " " "	-	-	-	-	-	-	-
" " " "	-	-	-	-	-	-	-
Section No. 12,	-	-	-	-	-	-	226 90

[illegible]

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS FOR THE YEAR ENDING SEPT. 30, 1896 — Continued.

Neponset Valley System — Concluded.

	1896.					Totals.
	May.	June.	July.	August.	September.	
Directors and all others,	\$1,925 62	\$5,813 26	\$242 55	\$3,569 57	\$4,250 07	\$22,515 20
.	250 00	250 00	250 00	250 00	250 00	8,000 00
.	594 40	207 56	57 98	206 67	214 86	1,518 05
.	179 45	30 00	108 47	103 29	153 22	1,001 43
.	1 40	-	-	-	1 05	38 90
.	108 65	57 97	-	3 60	28 84	278 60
.	180 65	168 90	224 60	122 76	95 87	966 98
.	45 30	18	1 30	80	49 37	130 70
.	26 75	-	-	43 20	25 17	162 55
.	15 00	-	12 00	-	34 00	79 00
.	516 66	516 68	-	-	-	2,583 38
.	125 00	125 00	-	-	-	500 00
.	125 00	125 00	-	-	-	500 00
.	26 50	5 25	-	-	2 00	7 25
.	254 17	-	-	70	68 73	145 43
.	72 40	-	-	-	-	1,016 68
.	952 74	574 30	25 46	12 68	26 14	1,591 32
.	20 00	20 00	-	-	-	40 00
.	1,873 94	2,564 96	2,303 42	2,182 60	9,502 94	18,604 76
Care of offices,						
Section No. 12,						

Section No. 13,	.	.	.	.	.	1,824 43	4,058 51	7,000 55	5,627 68	4,501 58	23,087 92
Section No. 14,	.	.	.	.	.	1,986 49	1,760 09	2,214 61	1,505 69	7,901 32	15,368 20
Section No. 15,	.	.	.	.	.	1,592 93	2,804 45	2,711 76	4,032 00	80 67	11,221 81
Section No. 16,	.	.	.	.	.	678 54	1,192 05	2,021 78	4,438 09	4,889 84	13,220 30
Section No. 17,	.	.	.	.	.	5 43	510 66	1,427 12	3,866 24	4,405 17	10,214 62
Section No. 18,	.	.	.	.	.	14 68	4,321 38	7,184 16	9,432 38	7,455 27	28,407 87
Section No. 19,	.	.	.	.	.	5 43	1,305 32	1,879 04	2,529 70	2,335 88	8,055 37
Section No. 20,	.	.	.	.	.	5 43	-	1,467 72	3,365 59	3,879 11	8,717 85
Section No. 21,	.	.	.	.	.	-	32 75	4 25	1,311 78	7,367 97	8,716 75
Section No. 22,	.	.	.	.	.	-	32 75	-	1,865 47	6,481 33	8,379 55
Section No. 23,	.	.	.	.	.	-	15 60	3 20	7 50	3,281 34	3,307 64
Section No. 24,	.	.	.	.	.	-	15 60	-	32 50	3,795 43	3,843 53
Section No. 25,	.	.	.	.	.	-	15 60	-	38 82	3,140 69	3,195 11
Section No. 26,	.	.	.	.	.	-	-	4 25	-	-	4 25
Land takings, purchase and recording,	.	.	.	.	.	-	4 00	-	-	8 31	15 96
Totals, .	.	.	.	.	.	\$13,356 99	\$26,527 84	\$29,144 22	\$44,499 31	\$74,226 17	\$200,604 35

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS
FOR THE YEAR ENDING SEPT. 30, 1896 — *Continued.*

Charles River System.

	1895.		
	October.	November.	December.
Salaries,—engineers, inspector and all others, including labor, . . .	—	—	\$5 00
Land takings, purchase and recording,	\$2,500 00	—	9,929 87
Legal services,	22 65	\$1,200 00	2,816 75
Experts and appraisers,	—	991 70	674 58
Grand totals,	\$2,522 65	\$2,191 70	\$13,426 20

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS
FOR THE YEAR ENDING SEPT. 30, 1896 — *Continued.*

Charles River System — Concluded.

	1896.			Totals.
	February.	March.	April.	
Salaries,—engineers, inspector and all others, including labor, . . .	—	—	—	\$5 00
Land takings, purchase and recording,	—	—	\$285 43	12,715 30
Legal services,	—	\$11 10	—	4,050 50
Experts and appraisers,	\$600 00	—	—	2,266 28
Grand totals,.	\$600 00	\$11 10	\$285 43	\$19,037 08
Amount charged off from "Office Expenses" and "Both Systems" to Oct. 1, 1895, . . . . .	. . . . .	. . . . .	. . . . .	33,760 94
Fifteen per cent. of office expenses for year ending Sept. 30, 1896, . . . . .	. . . . .	. . . . .	. . . . .	33 51
				\$52,831 53

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS
FOR THE YEAR ENDING SEPT. 30, 1896 — *Continued.*

Wakefield Branch.

	September, 1896.
Travelling expenses,	\$2 40
Tools and repair of same,	2 60
Field supplies,	0 20
Salaries, — engincers, inspectors and all others, including labor,	120 78
	<hr/>
	\$125 98

EXPENSES OF BOARD OF METROPOLITAN SEWERAGE COMMISSIONERS
FOR THE YEAR ENDING SEPT. 30, 1896 — *Concluded.*

Office Expenses.

	1895.			1896.		Totals.
	October.	Novem- ber.	Decem- ber.	Febru- ary.	April.	
Care of offices,	\$20 00	—	—	—	—	\$20 00
Travelling expenses,	4 91	\$7 26	—	—	—	12 17
Blue-printing,	15	—	—	—	—	15
Office supplies,	37 37	64 32	\$0 40	\$0 33	\$33 50	135 92
Maps, plans, blue-prints, etc.,	6 25	14 40	—	2 40	—	23 05
Postage, telegrams and ex- press,	—	11 45	14 00	63	—	26 08
Land takings, purchase and recording,	—	—	2 50	—	—	2 50
Clerical services,	—	—	3 62	—	—	3 62
Totals,	<hr/> \$68 68	<hr/> \$97 43	<hr/> \$20 52	<hr/> \$3 36	<hr/> \$33 50	<hr/> \$223 49

ASSETS AND LIABILITIES SEPT. 30, 1896.

ASSETS.

Office furniture, fittings and supplies, including fittings for field offices, stationery and railroad tickets,	\$2,890 84	
Engineering instruments and supplies,	2,260 83	
Engines, pumps, boilers, derricks, inclines, row-boats and heavy appliances,	3,198 00	
Pumping station fixtures, tools and supplies,	9,633 74	
Miscellaneous tools,	997 85	
Miscellaneous supplies,	1,760 78	
Engineers' field offices, sheds, barns, tool-houses,	2,262 00	
Stock yard and building, East Boston,	2,500 00	
House and lot, Pearl Street, Chelsea (due),	1,500 00	
Vacant lots, Winthrop,	1,800 00	
Cash received as follows: —		
Balance Sept. 30, 1895,	\$2,257 64	
Rent of house 63 Pearl Street, Chelsea,	38 00	
Rent of room 34, Walker building,	100 00	
Rent of pumps,	40 25	
Sale of pipe, chains, etc.,	75 08	
Sale of land in Winchester,	5,500 00	
Sale of house and lot, Pearl Street, Chelsea (on account),	500 00	
Sale of kerosene and naphtha,	19 69	
Change of man-holes, Winchester,	23 50	
Bond of F. M. Wells,	100 00	
	<hr/> \$8,654 16	
March 16, 1896, paid treasurer and receiver-general (chapter 251, Acts of 1892),	5,500 00	
	<hr/> 3,154 16	
		<hr/> \$31,958 20

There are numerous necessary plans, drawings, calculations and studies relating to the work to which no stated value can be assigned; also about fifty-four miles of completed sewer, with pumping stations, siphons and other accessories necessary for operating the systems.

LIABILITIES.

Amounts due contractors : —

Reserved on estimates (sewers),	\$39,673 15
Reserved on pumps,	12,900 00
Fractions of pay rolls (engineers),	1,352 89
Fractions of pay rolls (laborers),	235 93
Unpaid bills, miscellaneous,	1,325 82
	<hr/>
	\$55,487 79

There are also amounts due contractors upon a very few sections of the work, which will be paid on succeeding estimates or after the completion of the contracts.